Strategic Mobility 21

Southern California Agile Supply Network Final Report and User Manual

Contractor Report 0016

Prepared for:

Office of Naval Research
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Arlington, VA 22203-1995

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Prepared and Submitted by:

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This document describes a modeling framework, the Southern California Agile Supply Network (SCASN) simulation modeling system. This model, contracted to support SM21 for regional initiatives currently within Southern California, is intentionally designed to be flexible and generic such that it can be applied to any region or agile networking scenario.

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Dr. Paul Rispin, Program Manager
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Subject: Deliverable Number 0016, SCASN Simulation Model Software System Documentation and User Manual

Reference: Strategic Mobility 21 Contract N00014-06-C-0060

Dear Paul,

In accordance with the requirements of referenced contract, we are pleased to submit this SCASN Simulation Model Software System Documentation and User Manual for your review.

Your comments on this document are welcomed.

Regards,

Dr. Lawrence G. Mallon
Strategic Mobility 21 Program Manager

cc: Administrative Contracting Officer (Transmittal Letter only)
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Abstract

This document describes a modeling framework, the Southern California Agile Supply Network (SCASN) simulation modeling system. This model, contracted to support SM21 for regional initiatives currently within Southern California, is intentionally designed to be flexible and generic such that it can be applied to any region or agile networking scenario.

The overall SCASN model architecture offers numerous benefits for this project and beyond. Among them are:

1. A commercial off-the-shelf (COTS) simulation tool (ARENA) is used and preferred by USTRANSCOM.
2. Generic Implementation and Extensibility. Outline of physical and logical elements defined that can be reconfigured to represent enhanced regional infrastructure, etc.
3. Provides a **flexible, high-level network oriented view** that can be used for existing and SCASN infrastructure improvements.
4. It is **generic** such that it is possible to use this architecture for other regions.
5. **Any combination** of facilities and transportation connections can be explored.
6. The approach allows you to look at the entire region and its relationship to sourcing and shipments between nodes outside of the region (CONUS).
7. Provides the ability to create a "**Regional Network Flow Representation"** that synchronizes:
    a. Regional Infrastructure: Facilities, Transportation Links, etc.
    b. Transportation Strategies (freight volume flows through the infrastructure).
    c. Freight Volume Demands: Vessel, Rail, OTR, other arrivals.

1 SOUTHERN CALIFORNIA AGILE SUPPLY NETWORK MODELING SYSTEM DELIVERABLE OVERVIEW

This document serves as the final report and user's guide to describe the Southern California Agile Supply Network (SCASN) simulation modeling system developed to support the Strategic Mobility 21 (SM21) program. The implementation of SCASN used these previously delivered SM 21 documents as a basis of design and development:

1. SCASN Model Architecture Report, 9/30/2006
2. SCASN Model Prototype Report, 11/30/2006
3. SCASN Simulation Model Software System Documentation and User Manual, 3/1/2007

In addition to this final report and user's guide, a CD has been delivered with the SCASN software (with installation software) including the database with the debugging scenario. An animation of the debugging scenario is included on this CD as a visualization of the flow of freight and regional facility utilization (JPPSP, Port of Los Angeles/Long Beach)..

The development of the SCASN simulation model has been completed. Functionality testing to verify user-interface feature performance and model logic verification has been performed as a part of the development process. To support this final report and delivery, a debugging scenario was implemented using SCASN. This debugging scenario served to: 1) further identify functionality bugs, and 2) test the ability of the SCASN framework in terms of an actual conceptual military freight movement case. The debugging scenario chosen is based on a proposed military surge deployment scenario within the Southern California Region and includes Joint Power Projection Platform Rail Processes. This scenario is based on the processes described in an internal Strategic Mobility 21 IPT document "Military Surge Deployment Rail Shipment Requirements – Southern California Region & Joint Power Project Platform Rail Processes"

Also, as a part of the final report (on the delivered CD), a SCAN animation/visualization has been provided. A Window Media Player "playlist" file (SM21 Animation.wpl) is provided that creates an animated script consisting of multiple scenes. The scale of the Southern California region is large enough that separate scenes are necessary to be able to visualize activities. These scenes are individual ARENA animation movie files that show the status of a JPPSP (JPPSP1.avi and JPPSP2.avi) in Victorville and also for the waterside activities of a military deployment moving through a terminal within Port of Los Angeles/Long Beach (Polb1.avi)

A screen capture of the JPPSP facility animation is shown in the following figure.

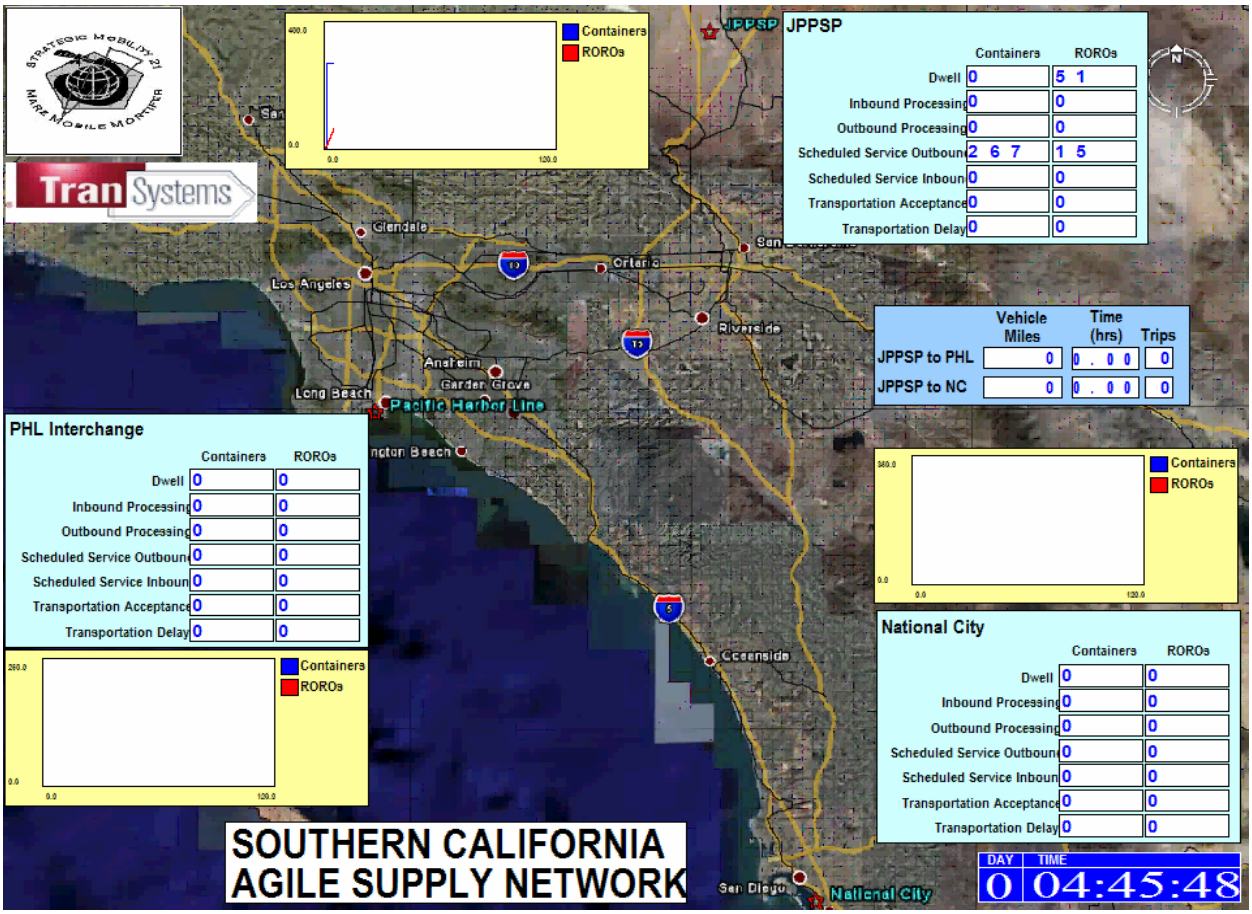

Figure 1: JPPSP in Victorville SCASN Animation Scene

In this scene, trains can be seen moving from Victorville towards the Port of Los Angeles/Long Beach and National City. Statistics are displayed to show the train travel times as well as number of freight units at the Pacific Harbor Line Interchange and other areas.

The scene of the activities at Port of Los Angeles/Long Beach is shown in the following figure:

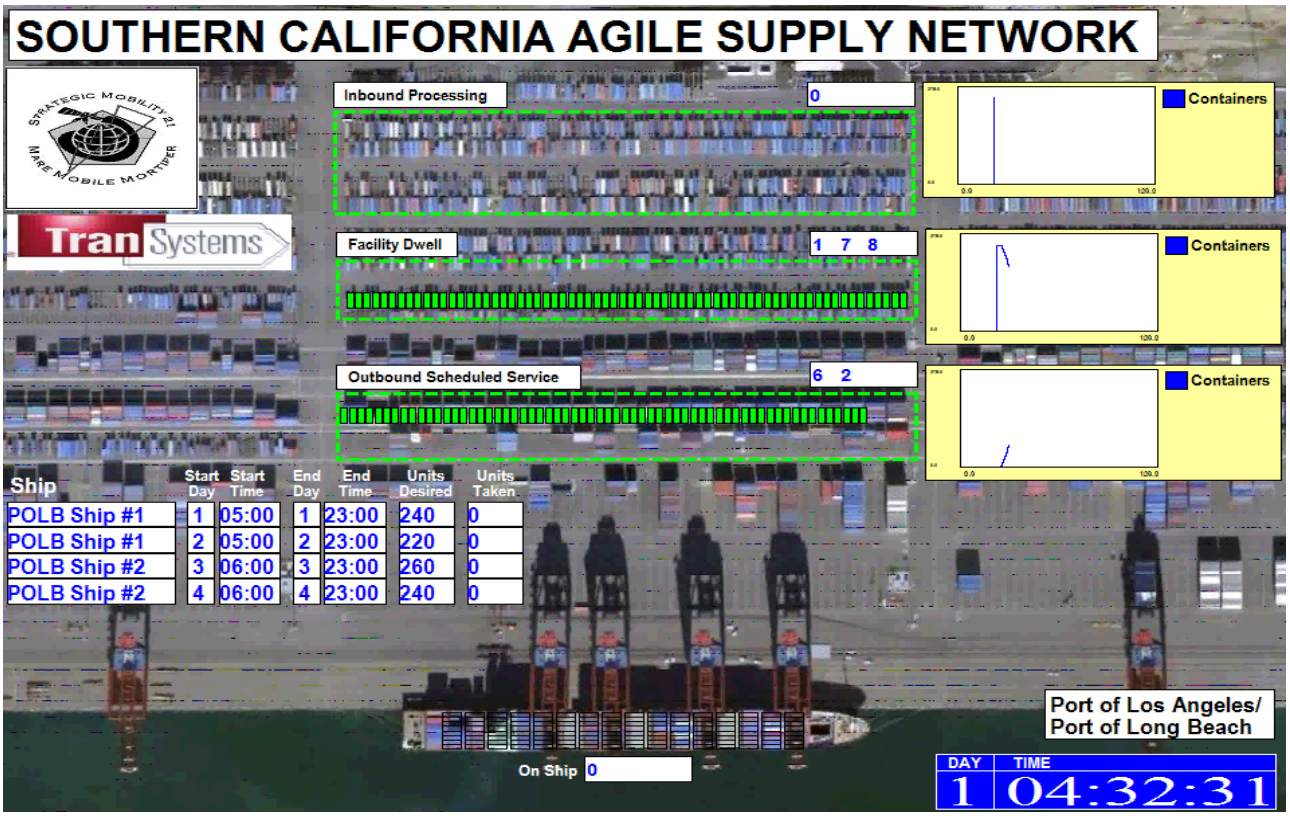

Figure 2: Military Deployment at Port of Los Angeles/Long Beach

In this figure, the scene showing freight units being loaded from a marine terminal onto an outbound military vessel are shown. The number of freight units waiting to be loaded and the amount of time the ship requires for loading is displayed.

Both of these scenes were generated by SCASN with the data used for the military deployment debugging scenario. It provides an example of how freight movements and facility capacity can be visualized within the scope of a large region such as Southern California. SCASN does not automatically produce these animations; however since it is built using ARENA which supports COTS animation capability, it is possible to animate statistics and make icons to represent freight units, transportation entities and other elements as needed.

2 SUMMARY OF SCASN RESULTS AND CAPABILITIES

2.1 RESULTS OF DEBUGGING SCENARIO

The debugging scenario provided a framework in which SCASN was validated in terms of its ability to represent the primary elements of an actual military deployment plan. The primary activities outlined in the military deployment scenario are included. This includes an initial military surge deployment scenario managed by the JPPSP with the concurrent shipment of containerized sustainment through the POLB and the sequenced movement of military forces through the POSD.

Throughout the architecture and development of SCASN, significant experience and research was applied to ensure that the overall parametrical framework supports the analysis needs for representing both commercial and military freight flow scenarios.

The implementation of the debugging scenario served as an additional validation step for the first release of SCASN. The process used for the debugging scenario implementation includes:

1. Determine how existing SCASN inputs can be used to configure the proposed freight flows within this scenario.
    a. Where needed SCASN model logic and/or model inputs were revised to adequately support the implementation of the military debugging scenario.
    b. During this process, SCASN was found to be mostly accurate: the nature of the adjustments were mainly the adjustment of some of the input form designs to reduce redundancy and improve usability.
2. The SCASN model was tested using a sequential process.
    a. Parametrical inputs to support the debugging scenario were progressively implemented such that it facilitated the identification of errors or model logic issues.
    b. This process allowed for verification of input and output relationships to ensure logic robustness.
3. The SCASN output log formats allowed for individual freight units to be traced and their flow behavior through the Southern California freight flow to be validated.
    a. The detailed nature of the log files allowed for each event to be observed in terms of simulated time of occurrence, facility location, and unit progress within each facility.
    b. This detail was instrumental in determining model accuracy as well as fine-tuning the ability of the SCASN model to produce needed output reports.

Through this process SCASN was able to represent the primary features of a proposed military deployment scenario and produce valid results based on the input parameters. The scope of the debugging scenario included the following facilities:

- Tracy: Military source of freight outside Southern California
- Susquehanna: Military source of freight outside Southern California
- Other PPP: Other military sources of freight outside Southern California

    - Camp Lejeune
    - Mechanicsburg
    - Red River Army Depot
    - Hill Air Force Base
    - Memphis Depot
    - Richmond
    - Jacksonville
    - Norfolk GSA
    - Richmond Defense Supply
    - MCAS Cherry Point
    - Philadelphia DPSC
- JPPSP in Victorville: Facility to receive stage and assemble freight units for POLA/B)
- National City: Roll-on, Roll-off unit handling to support military forces
- Port of San Diego: Outbound vessels with roll-on, roll-off freight units to support military forces
- Pacific Harbor Line Interchange: Interchange of containerized freight units sent by rail from JPPSP into Port of Los Angeles/Long Beach terminal
- Port of Los Angeles/Long Beach: One or more marine container facilities (T125-126) that is used to stage and lift containerized freight units onto outbound vessels.
- Deployment Destination: A generic outbound destination for the military deployment outside of Southern California.
- Fort Irwin: Military source depot within Southern California for roll-on , roll-off freight units to support military forces.
- Twenty-Nine Palms: Military source depot within Southern California for containerized freight units.

The military debugging scenario focused on the movement schedules of freight units by rail and out from the region via vessel. The types of rail and freight movements modeled include:

- Originating freight from Tracy to JPPSP in Victorville, CA (rail)
- JPPSP in Victorville, CA to Pacific Harbor Lines Interchange (rail)
- PHL Interchange to POLA/B (rail)
- POLA/B to Out of Region (vessel)
- Originating freight from Ft. Irwin to JPPSP in Victorville, CA (rail)
- JPPSP in Victorville, CA to National City, CA (rail)
- Port of San Diego to Out of Region (vessel)

The SCASN parameters and outputs to support this debugging scenario are shown in the following user's guide documentation.

2.2 SCASN DEVELOPMENT STATUS

For this final report, SCASN is delivered as a "first release" working version. As with any first release software tool, there are always opportunities to increase usability and stabilize functionality as it is used on an ongoing basis. Also, as the SM21 program continues, there is interest in using SCASN for a variety of uses—including expansion of the analysis region

through most of California and possibly applying the tool for other scenarios or regions.

To support further use of SCASN by TranSystems, by California State University at Long Beach (or others), a "Technology Transfer" set of tasks is recommended as a follow-on phase. This outline is provided as a suggestion for Technology Transfer--any or all of these tasks can be executed as desired. This includes:

2.2.1 Suggested Technology Transfer Tasks

1. Further validation of SCASN using a complete military deployment data set.
2. Further "production hardening" of SCASN using a combination military and commercial scenario or other scenario.
3. User Interface "usability" enhancements—a variety of features as identified during ongoing use.
    - Add functionality and streamlining of forms as identified during continued use.
    - Data validation checks to facilitate identification of user entry errors.
    - Increased integration of Visio within SCASN to assist user in "visualizing" data.
4. Preparation of training materials.
5. Conduct training classes and workshops.
6. Ongoing technical support
    - Phone and/or email support as needed by SCASN users
    - Fix any critical bugs or issues that are identified through ongoing SCASN use.

In addition to technology transfer, SCASN can evolve from its current focus of being a parametrical model that provides a regional time-domain freight flow representation to one that integrates increased dynamic logical functionality.

For example, the time that it takes to travel a transportation link (especially rail) to get to a next destination is currently based on user inputs for expected travel time (with variability) by time-of-day, day-of-week. This method works well, especially with rail links with historical data, but there could be logic integrated to dynamically calculate rail link capacity for new rail links and for scenarios where significant shifts in traffic volume may occur.

2.2.2 SCASN Logical Functionality Enhancements

A list of some potential SCASN logical functionality enhancements is provided as follows—any or all of these enhancements could be implemented as needed.

1. Rule-based Decision Logic: Dynamically select freight flows based on current system conditions such as congestion, expected time delays, link outages, and others. The current SCASN model allows for alternate routing based on time-out conditions—expansion of this "rerouting" capability can be implemented.

2. Dynamic Transportation Link Capacity: Provide the ability to calculate current usage levels of transportation links to 1) provide ability to analyze link level of service for those that do not have historical data, and 2) provide ability to reflect ability of link to absorb

significant increased volumes.

3. Expanded Variability Elements: SCASN currently has variability associated with travel times, facility dwell times, and others. For example, the first release of SCASN assumes that originating freight to the region always occurs as scheduled. The logic for SCASN could be expanded to allow for variability of freight units arriving to the region, etc.

4. Related Trips Logic: SCASN allows for scheduled services with designated "shipment assets" to be specified. In some cases, there are interchanges that occur where a shipment asset travels through multiple facilities from origin and destination. The SCASN logic can be enhanced to recognize that a shipment asset is continuing through a facility and that a departure from a facility that uses a particular shipment asset might be impacted by a "late" arrival of that asset. The SCASN logic can be enhanced to represent the management of shipment assets through the region.

3 SCASN USER'S GUIDE

3.1 SCASN MODEL INTRODUCTION

The SCASN model is actually a modeling system that integrates or links multiple applications. These include:

- Microsoft Visio as the environment for freight flow definition
- Microsoft Access as the internal, integrated database.
- Rockwell Software Arena for the simulation and animation.
- Microsoft Excel for output reporting and graphs
- Scenario management utilities.

The architecture and organization of SCASN uses a multi-layer architecture:

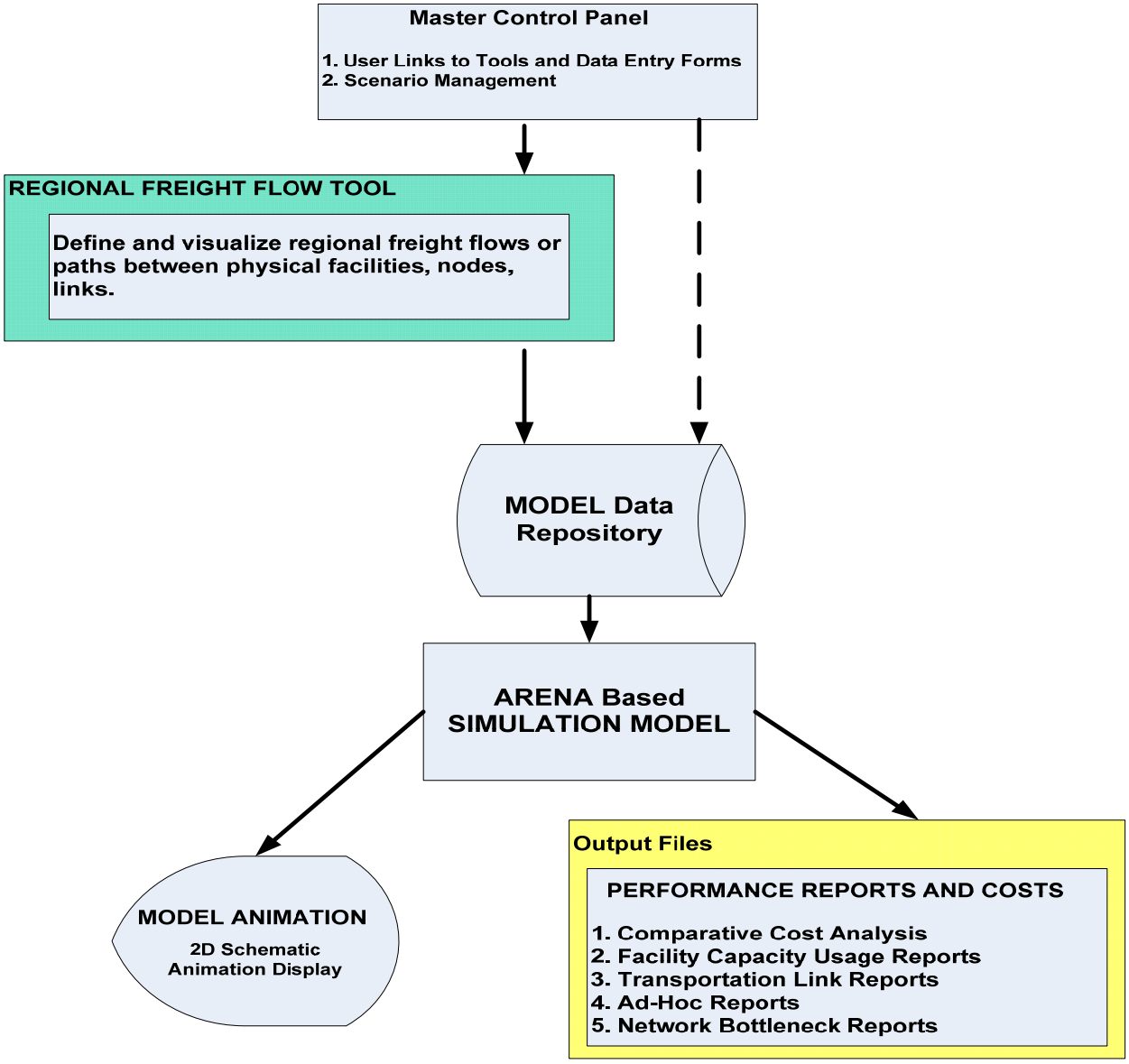

Figure 3: SCASN Model Architecture

3.2 SCASN SYSTEM REQUIREMENTS

The SCASN modeling system is a stand-alone, single user, single server application. It can be installed on most desktop PC configurations that have:

- Microsoft Windows XP Professional (or better)
- Microsoft Office 2003 or better
- Microsoft Visio 2003

- Rockwell Software Arena (version 12.0)
- Microsoft .net framework 2.0

3.3 GETTING STARTED WITH SCASN

An installation CD with the SCASN software system has been delivered with this final report. On this CD will be an install program that will automatically install the software on the target computer. Before installing the SCASN software system on a target computer, make sure the computer has the necessary supporting software installed as outlined in the Systems Requirements section of this document.

Steps for SCASN installation:

Step 1: Insert SCASN installation CD into target computer.
Step 2: Run the installation program on the CD.

To start using SCASN, go to the Microsoft Windows start menu, go to "All Programs" and you will notice an SM21 application folder/icon. Once this has been selected, a "SCASN Simulation Model" link will appear. Select this link to start using SCASN.

The installation program will also automatically create the file structure within the installed directory needed to utilize the SCASN software system. It is not necessary to go to these files within normal SCASN use, but this general file structure is provided for user reference:

- **Animation –** Contains the example .avi (movie files) of SCASN animation scenes.
- **Model** – Arena master file (Stratmob21.doe)
  - **Source** – Arena Source code that is generically useful for Arena modeling projects
    - **StratMob21** - All Arena source code specifically created for SM21
  - **Storage** – This folder contains zipped up scenario files used by the scenario manager.
  - **System** – Modeling Studio (Master Control Panel) executables and related dynamic link library (.dll) files
  - **Template –** Master (blank copies) of the freight flow representation and SCASN internal database.
- **Working –**
  - **Inputs –** Text format data files that the Arena model reads in.
  - **Outputs -** Text format output files written from Arena and Microsoft Excel (.xls) files that contain model outputs (and graph templates, etc.)

4 SCASN MASTER CONTROL PANEL USER INTERFACE

All of the modeling and analysis activities are centralized within the SCASN User Interface or the "Master Control Panel" (MCP). On this MCP there are links on the left side of the interface that directly launch the modeling studio components such as Visio, the database entry forms, scenario manager, etc. The SCASN MCP screen is shown in Figure 4: SCASN Modeling Studio Master Control Panel.

Figure 4: SCASN Modeling Studio Master Control Panel

4.1 USER WORKFLOW

The links on the SCASN MCP are organized in a "top-down" orientation that generally corresponds to the typical user workflow.

4.1.1 Scenario Manager

The top MCP link, the "Scenario Manager" is usually the first step in the user workflow. The user will use this utility to create a new scenario, modify a previous scenario. When this link is selected, the following scenario manager screen is displayed:

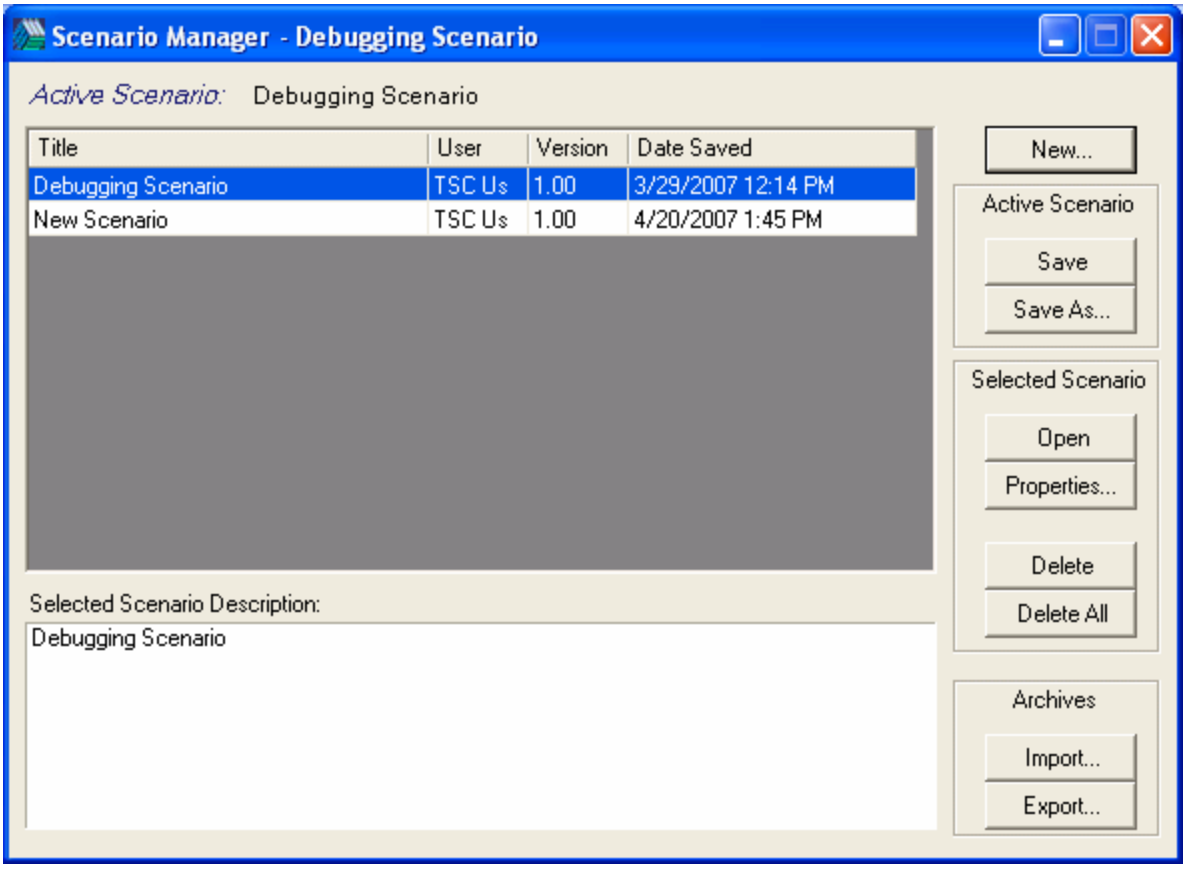

Figure 5: Scenario Manager Form

In order to allow users to better organize their scenarios (inputs and outputs), SCASN has a scenario management capability as one of its core components. As new analysis questions arise, it is important to have a mechanism for "saving" the model information into a defined scenario that can be easily retrieved for future analysis.

The Scenario Management utilities provide the following functionality:

- Create a new scenario
- Load an existing scenario
- Modify an existing scenario and save it under a new name (creating a copy)
- Delete a scenario
- Export one or more scenarios to a scenario archive file
- Import one or more scenarios from a scenario archive file
- Enter descriptive comments (and possibly other information) about a scenario
- Rename an existing scenario

The *Scenario Manager* form (Figure 5: Scenario Manager Form) allows you to restore

previously archived scenarios and create new scenarios. A "scenario" consists of all of the inputs and outputs for a project.

> Tip: During an analysis session, it is often useful to save scenario as a "baseline scenario". If this is done, then while different "what-if" conditions are tested, it is always possible to return to the initial baseline conditions.

If you want to open, delete, save, or edit an existing scenario, you must first select the scenario by clicking on the scenario title shown in the select list.

As can be seen in the above figure, SCASN is currently loaded with a Debugging Scenario—a blank scenario "New Scenario" is displayed ready for a user to rename and populate with a new scenario.

To save as a new scenario, select *Save As…*. A dialog box will appear which will allow you to enter a title, a user ID, and a description to attach to your scenario. (If at a later time you want to edit any of these entries, select *Properties…* to reopen this dialog box.) To overwrite the selected scenario, choose *Save*.

To restore a previously archived scenario, select *Open*. Caution: Opening a data set will overwrite your current scenario so be sure to save your active scenario if you'll want to restore it later.

If you would like to clear out an existing scenario, select *Delete*.

SCASN also supports the creation of a *scenario archive file*, which allows scenarios to be shared with another user. For example, one analyst may export one or more interesting scenarios into a scenario archive file, and email it to a second analyst in a different physical location. The second analyst can import the scenario archive file so that it can be added to the list of scenarios already on his computer. (Note that this feature has multiple benefits—it can facilitate the use of predefined "templates" between users.)

4.1.2 Library Data

The second link on the MCP is "Library Data". This is a link to a form where structural or reusable type data entries (across multiple facilities) are organized. These values may be referenced in pull down list fields by other SCASN components (Freight Flow tool) as well as other form entries (Facility Data forms).

The links associated with Library Data include:

- General Data- This launches a form with multiple tabs:
  - Facilities
  - Shipment Assets
  - Trigger Events
  - Freight Types
  - Delays
- Daily Profiles
  - Processing Schedules
  - Transport Schedules

From a workflow standpoint, it is a good idea to populate the library data to some degree of completeness so that it is possible to reference this data when needed in other forms. It is possible to go back and forth between forms when it is realized that some library data needs to be added to support other form entries.

General Data Forms: In this step of the workflow, it is suggested to minimally define the facilities. This will be necessary for defining the freight flows within the next step. The user can define as many facilities as desired within the Facilities form (Figure 6: Library Data: General Data: Model Facilities Form) to support the regional infrastructure.

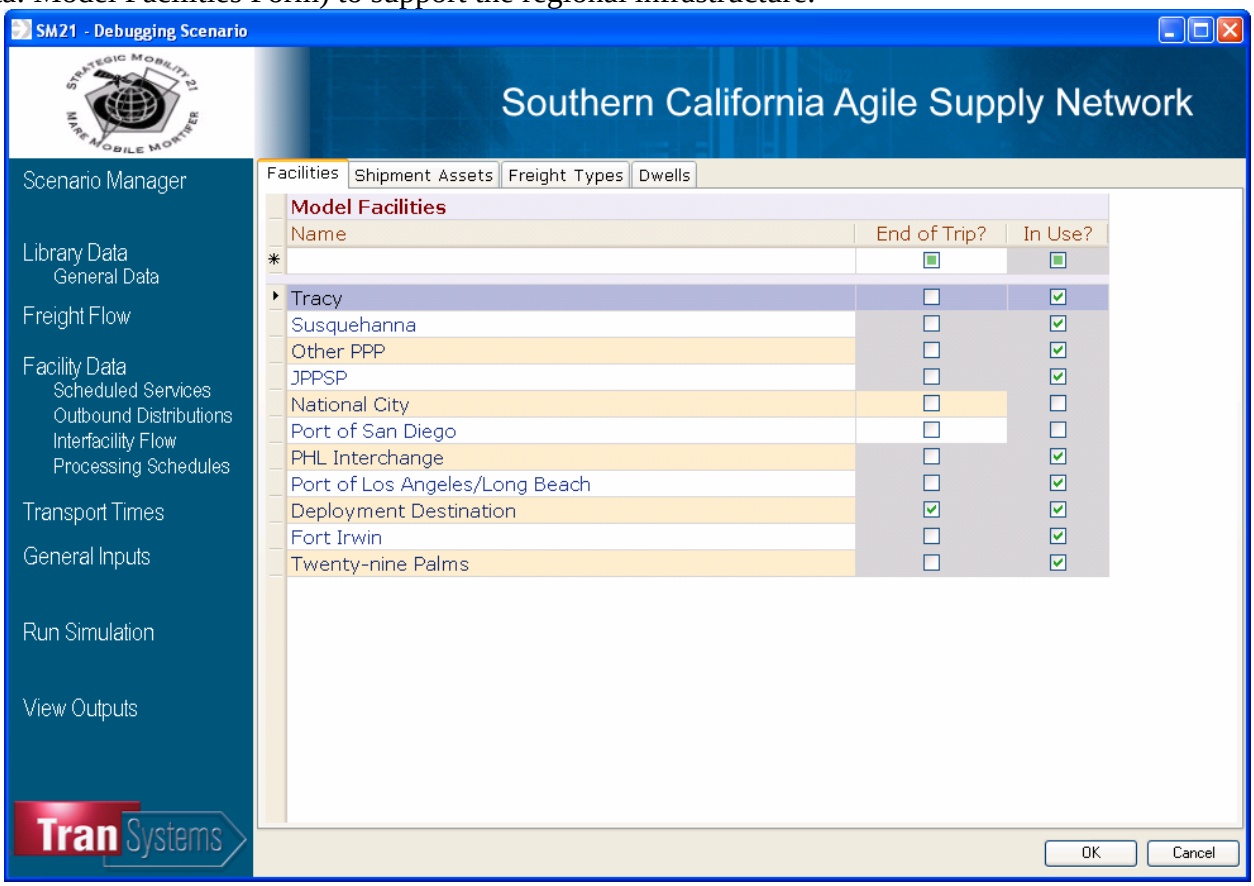

Figure 6: Library Data: General Data: Model Facilities Form

There are three fields for data entry:

FIELD	DESCRIPTION	NOTE
***Name**	This is the name of the facility for reference and data definition purposes.	Make sure names are unique.
***End of Trip?**	This is a "on off" or "yes no" switch to note if this facility will be the end of the trip for freight units. This is needed to tabulate freight unit cyclic time and other statistics for the SCASN output module..	The default setting for this is End of Trip? = "no".

***In Use?**	This is the processing rate in "freight units" per hour.	The default setting for this field is In Use? = "yes".

:

Also, at this step of the workflow, it is useful to populate other types of information such as "Shipment Assets". These are used when defining "Scheduled Services" in another form and are used to represent specific types of transportation equipment such as vessels, trains, etc.

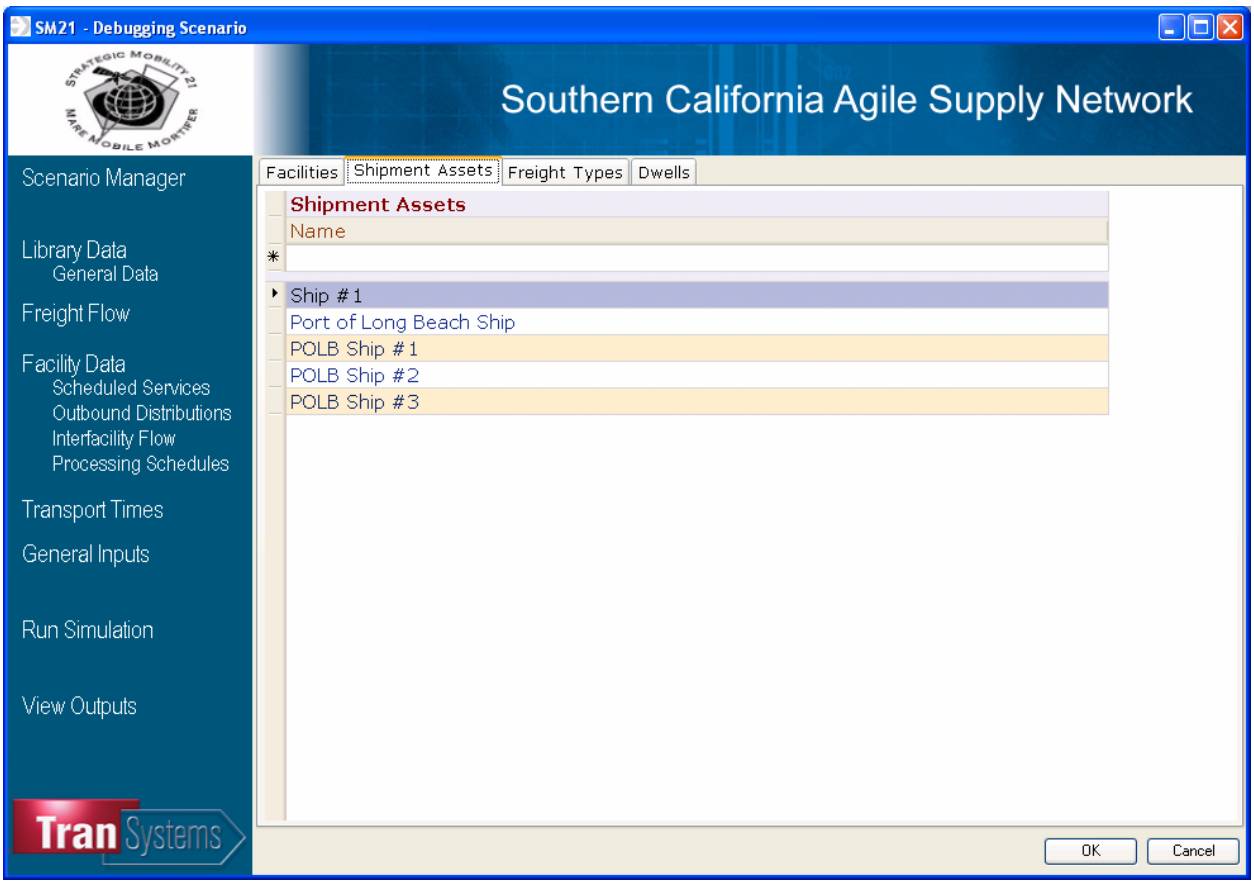

Figure 7: General Data: Shipment Assets

Also, as a part of the general data is a form that allows for freight types to be defined. These are used to prioritize or sequence particular freight types within scheduled services and other purposes such as reporting quantity of units within a facility, etc. Any number of freight types may be defined to support a scenario—this is useful for Military Deployment scenarios where specific freight types will need to be defined with unique vessel loading requirements.

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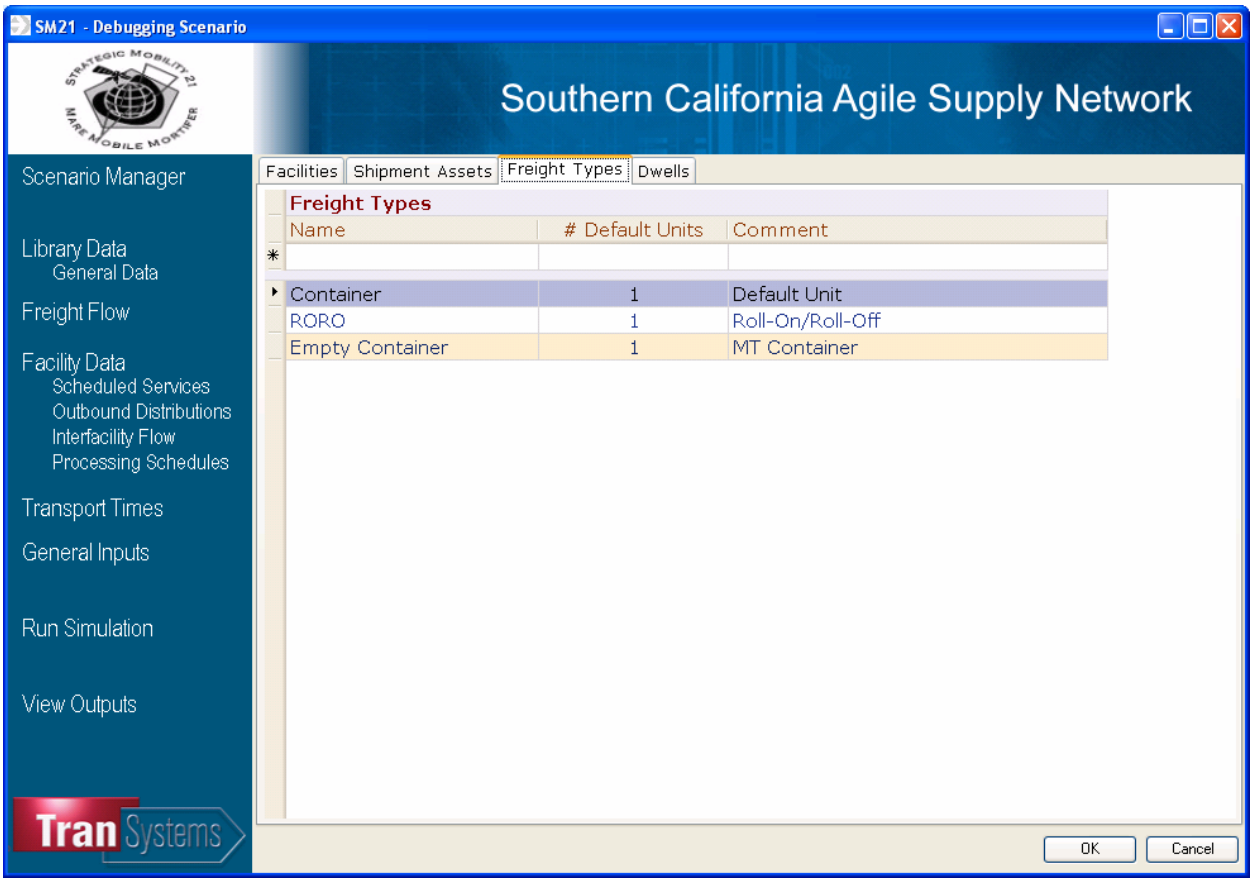

Figure 8: General Data: Freight Types

As a part of the processing of freight units within facilities there are dwell times that need to be defined within the "Facility Data" forms. The dwell time format for SCASN uses a triangular distribution that is defined with a minimum, mode, and maximum time parameters. The time units are entered in hours.

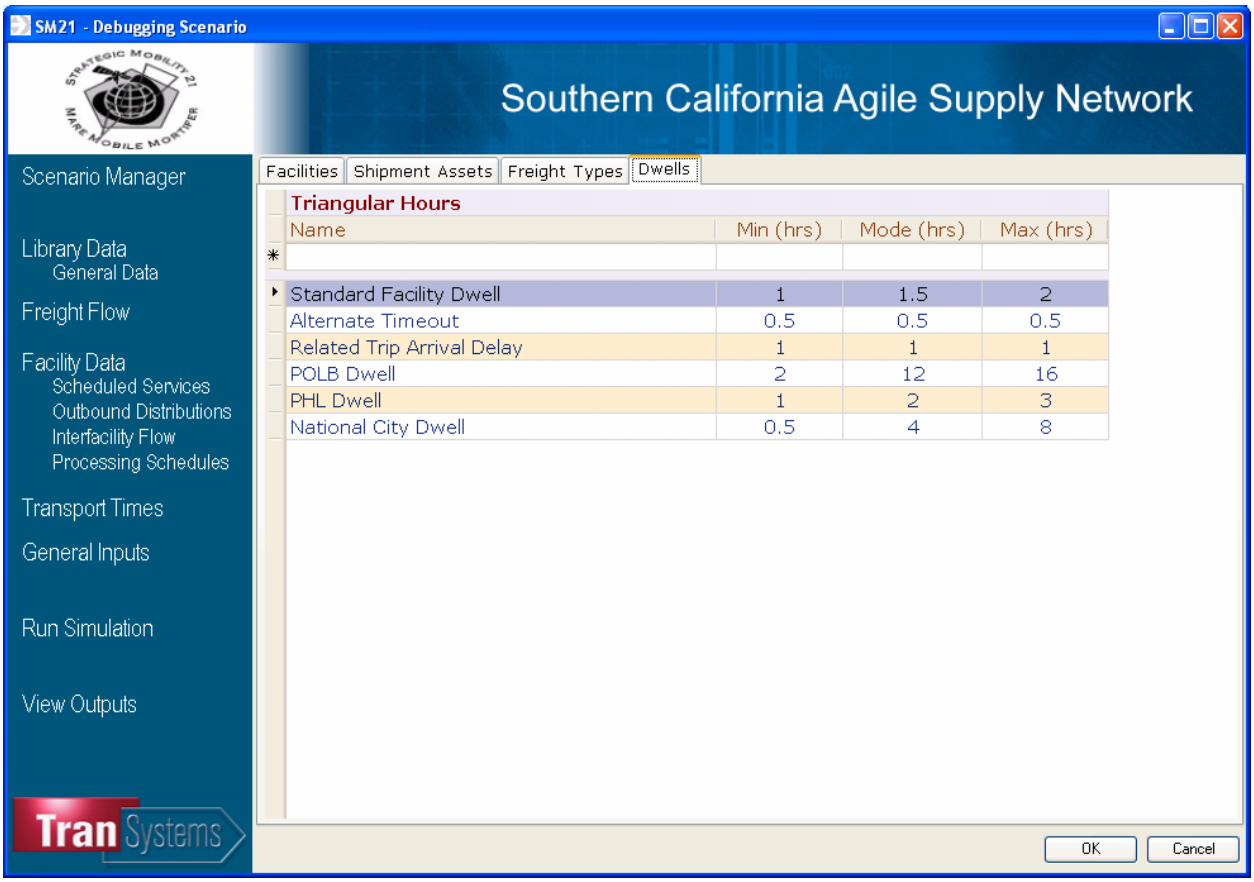

Figure 9: General Data: Dwells

4.1.3 Freight Flow Tool

The third link on the MCP is the "Freight Flow" which launches a customized Microsoft Visio application that has been designed to work with the other components of SCASN.

This flowcharting tool serves as the creation of the regional infrastructure and for the definition of the freight flows between them. When the user selects this link, Microsoft Visio is launched and a customized stencil will appear to enable the user to define regional facilities as well as freight flows (import or exports, etc.) between them. A view of the custom stencil and flowcharting environment provided is displayed in Figure 10: Freight Flow Tool Environment.

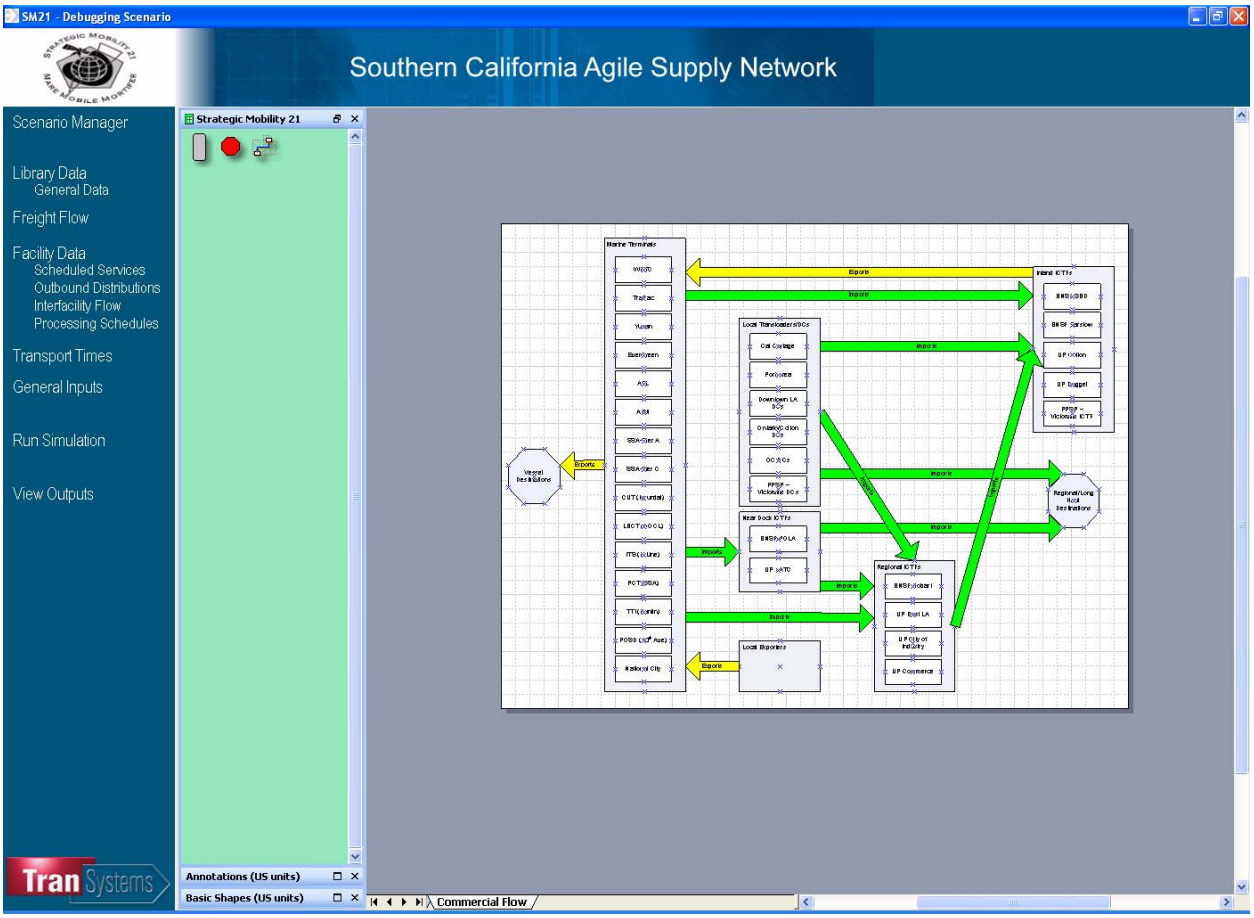

Figure 10: Freight Flow Tool Environment

The stencil is the set of shapes within the green area on the left side of the environment. There are 3 shapes available to "drag and drop" onto the flow chart:

1) Facility Group
2) Out of Region
3) Import/Export Flow Connector

These shapes are the building blocks or elements to create the infrastructure and freight flow connections. The user is limited to this set when creating a regional freight flow representation.

When a Facility Group shape is dragged from the stencil onto the page, a form will be displayed to show the defined facilities (defined within the Library Data). The user can select one or more facilities to associate with that Facility Group.

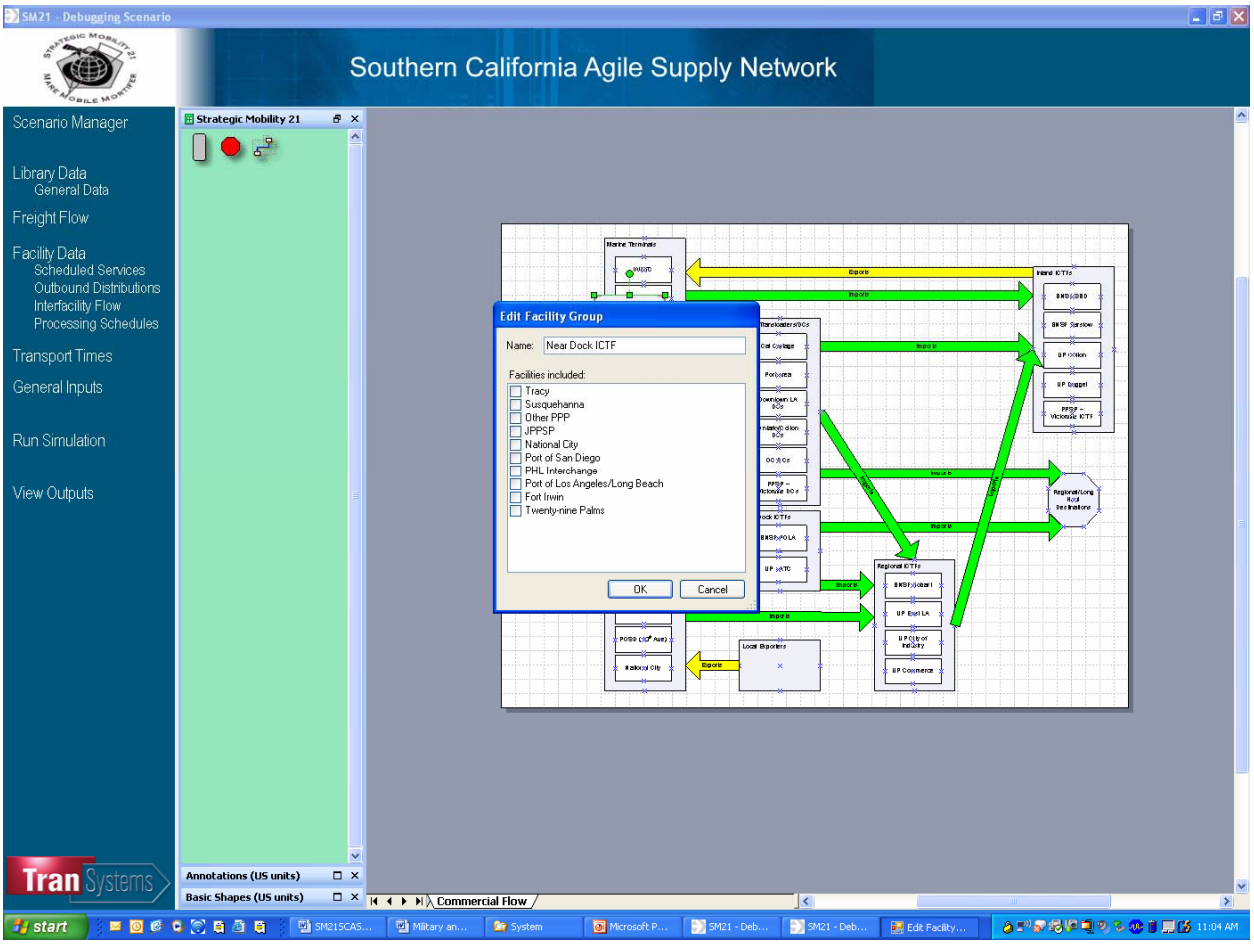

Figure 11: Process Group Definition within Freight Flow

The user can connect facility groups using the Import/Export connector. When the connector is attached to two facility groups, a form appears requiring the user to select "import" or "export". The selected option is displayed on the connector arrow on the drawing page.

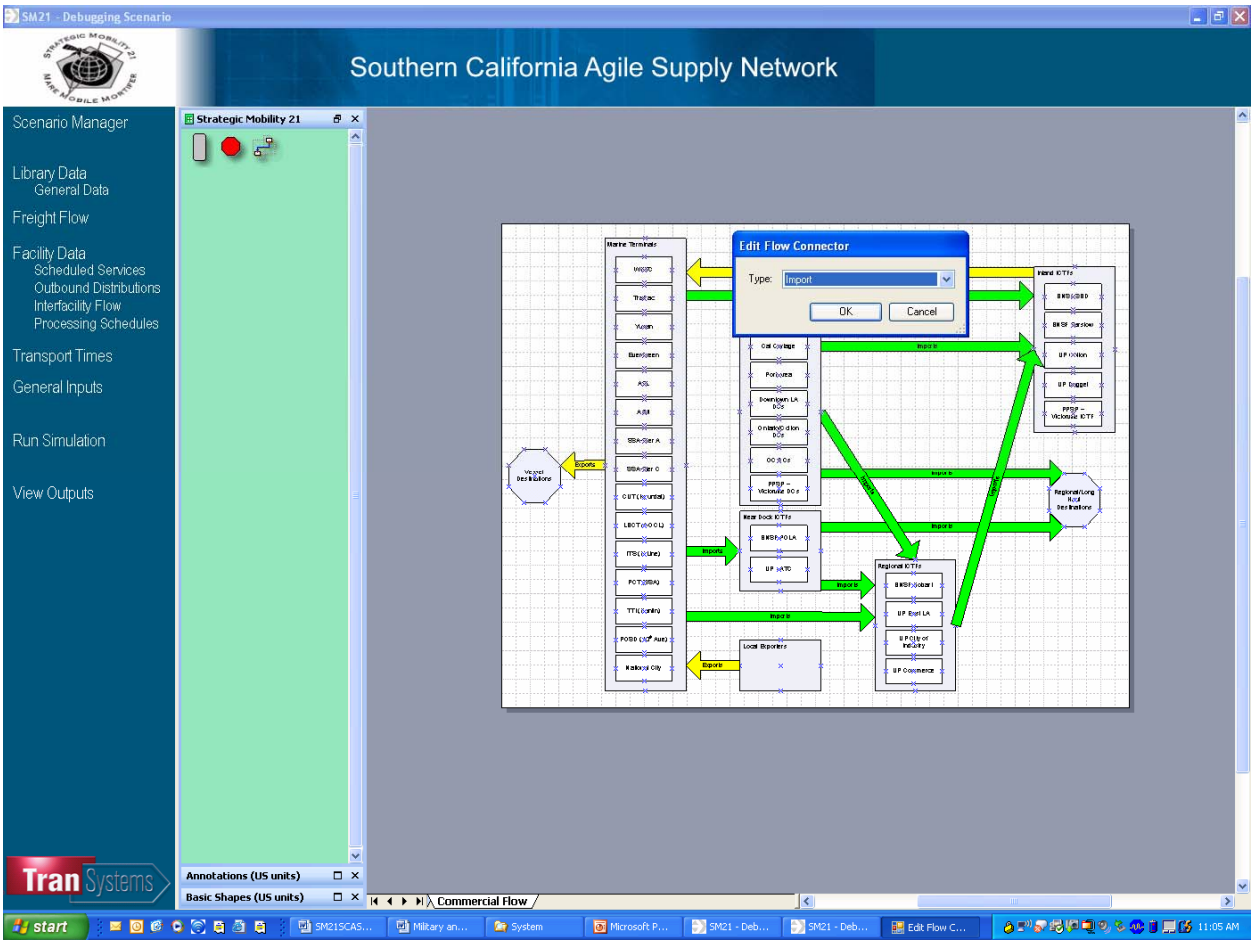

Figure 12: Freight Flow Tool Connector Shape Properties

The basic structure of a freight flow representation within SCASN centers about the concept of Facility Groups. A facility group is usually defined as a group of similar types of facilities that are likely to have similar freight flow characteristics (but not forced to be identical). The concept of a facility group facilitates and consolidates the regional freight flow representation. An example of this could be marine terminals within Port of Los Angeles or Port of Long Beach. Most of these facilities will have similarity in that they will have freight flows to nearby transloading, local, and ICTF facilities.

When the user attempts to close the file or this application, a prompt will be displayed to allow the user to save and update the SCASN database. If the user selects "yes", the flow chart information will be updated to the database. A summary of the automatic database update process is:

1. Any freight flows between facilities that are not currently in the database will be created. The automatic database update creates a record for each "from" facility in a facility group to each "to" facility in a facility group. Note that some of these connections may not be

physically needed, but they are comprehensively created (as records in the database). The user has the option to not use created freight flow connections as desired.

2. Any freight flows between facilities that were in the database that are not currently displayed on the flowchart will be flagged as "inactive" but the data associated with that freight flow will remain in the event that this freight flow is potentially reactivated.

Note that the automatic database update procedure does have the potential to change the underlying definition of some related SCASN elements such as "scheduled services", etc. For example, if a user has previously defined a "scheduled" service such as a train that goes between two specific facilities and one of these has been removed, the user will need to redefine or refresh what is needed for that scheduled service.

The user has the option to say "no" and only save only the Visio flowchart if it is desired to update the database at a later time. Because the automatic update of the database can substantially change some previous database entries, care must be taken when deciding to update the underlying database.

It is expected that once the basic regional infrastructure and freight flows are defined that these could be used for many scenarios. For example, it might be preferred to create a regional representation with all types of facilities (existing and proposed) and "shut off" unused facilities that are not applicable within a scenario.

4.1.4 Facility Data

The fourth set of links on the MCP is for "Facility Data". There are a series of sublinks associated with this section that each launch off individual forms for further data entry.

- Scheduled Services
- Outbound Distributions
- Interfacility Flow
- Processing Schedules

In applicable fields there will already be pull-down lists within these forms to reference previously defined lists such as facilities, etc.

Scheduled Services: This form is used to enter data associated with scheduled services such as vessel arrival/departure, train arrival/departure and any other type of shipment asset that is used to move multi-unit freight volumes.

Scheduled services can serve to bring originating volumes to a facility and/or depart outbound volumes. Originating volumes are those that are starting their flow within the region at this facility. Outbound volumes are those that have arrived from another facility within the region (via an inter-facility flow). Originating volumes must be defined using scheduled services—if it is desired for experimentation to immediately "create" originating volumes without a real physical shipment asset this is possible by putting a "placeholder" asset that only has a purpose to originate volumes at a facility node.

A single scheduled service can potentially have many records within the form attached to the same shipment asset. For example, there may be a sequence of loading that must occur such that certain freight types must be loaded prior to others (to reflect a stow plan design, etc.). This could also be used to define that the shipment asset must be unloaded to a certain level prior to loading, etc.

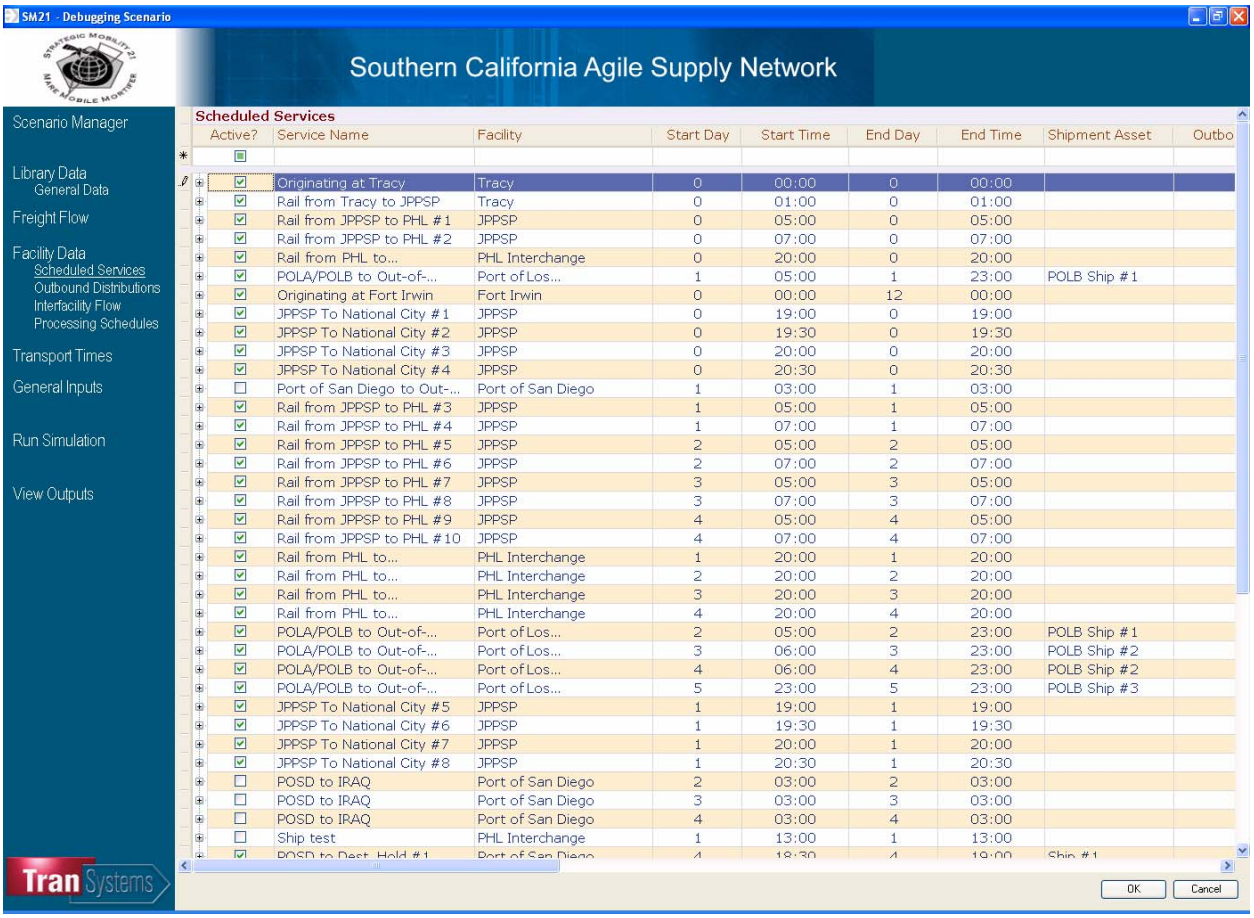

Figure 13: Scheduled Services Definition Form (Part A)

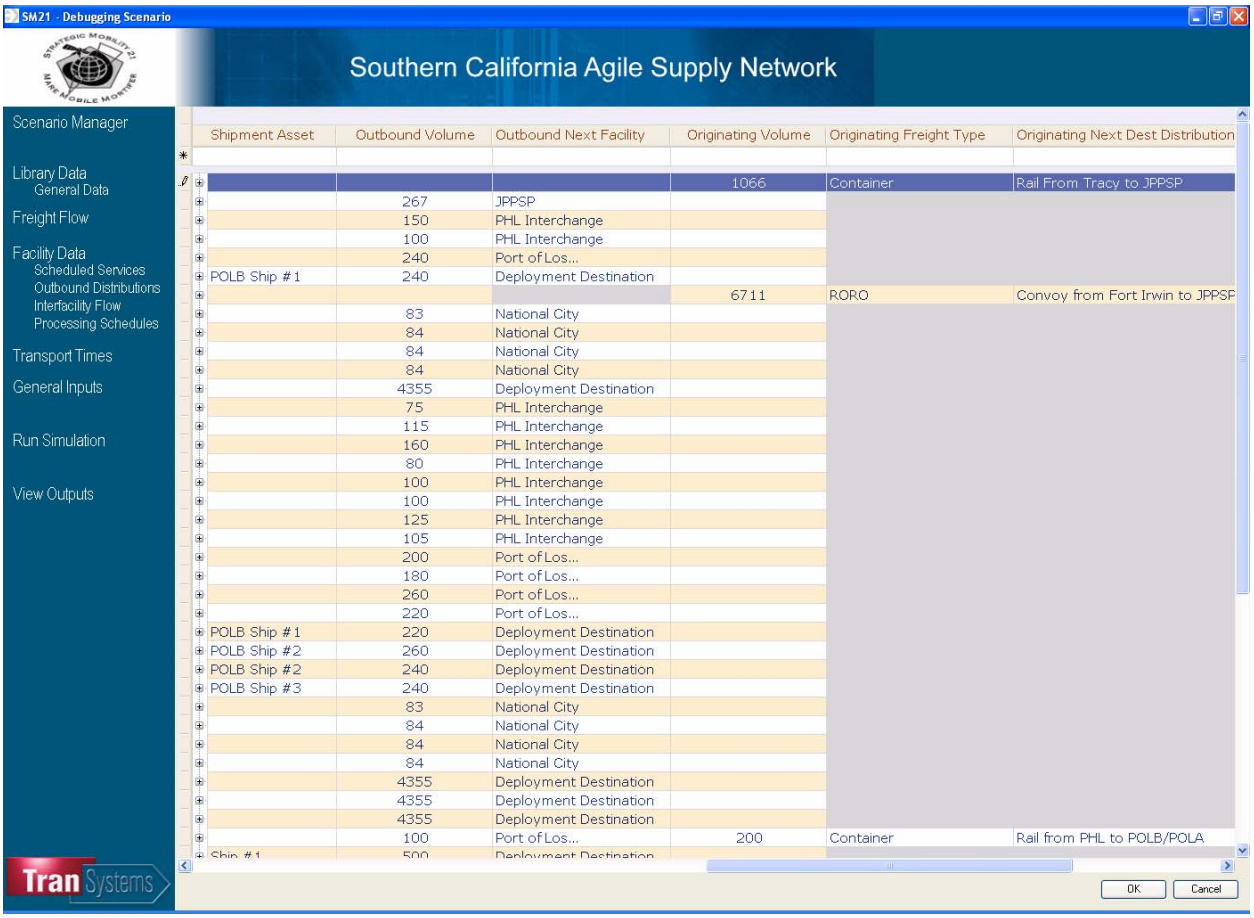

Figure 14: Scheduled Services Definition Form (Part B)

The following table describes the various field entries on this form. The fields noted with an asterisk (*) are mandatory entries.

FIELD	DESCRIPTION	NOTE
Active?	This is a toggle that allows for scheduled services to be created and activated/inactivated as needed to support the scenario.	The default value of this field is "active". This is a convenience feature for the user to shut on or off services as needed.
Service Name	This is a user defined name (not used by model) to reference the scheduled service.	
***Facility**	This is a pull down list of the facilities defined within the "library data" section.	If a facility does not appear in the pull down list, it must be defined in library data within the facilities tab/form.
***Start Day**	This is the starting day that this scheduled service sequence will or can begin.	Note that the starting day and ending day do not need to be the same in the event that this loading/unloading sequence occurs across multiple days.
***Start Time**	This is the starting time on the starting day that this scheduled service sequence will or can	The format of this entry is HH:MM.

	begin.	
***End Day**	This is the ending day that this scheduled service sequence must end.	Note that the starting day and ending day do not need to be the same in the event that this loading/unloading sequence occurs across multiple days.
***End Time**	This is the ending time on the ending day that this scheduled service sequence must end.	The format of this entry is HH:MM.
***Shipment Asset**	This is the physical asset that is used to arrive and/or depart freight volumes. If a scheduled service has multiple sequence records, it is important to assign these to the same physical asset so that output reports can indicate quantity of freight units loaded, etc.	If the same physical asset is scheduled to arrive/depart the facility multiple times during the scenario (like a schedule that repeats weekly, etc.) each visit to the region must be identified with a unique identifier.
Outbound Volume	This is maximum volume in (units are the minimum default freight unit used for the scenario) that can depart via this scheduled service. The shipment asset can depart with less than this volume if it insufficient volume is at the facility, but it cannot leave with more volume.	It is not necessary to have an outbound volume assigned to a scheduled service; however, a scheduled service record must have some volume (originating or outbound) assigned to be valid.
Outbound Next Facility	This is the next facility for these freight units on this scheduled service.	
Loading Plan Priorities: Freight Type	Associated with an outbound volume, is the capability to specify loading plan priorities. For each outbound volume, a unique set of priorities for loading freight units can be specified with this subform. If there are multiple freight types at a facility, this list specifies what types of freight units can be loaded and with what priority if there is insufficient volume to support all freight units ready to depart from a facility. This is a pull down list field that references the freight types that have been defined within the "library data".	It is possible to have a "null" list of freight types and priorities—the model will treat this case as all available freight types departing on a first-in, first-out basis.
Loading Plan Priorities: Priority	This is the priority of the freight type for being loaded onto the shipment asset.	The priority values can be equal or different integer values from other freight types on this list. Lower integer values are interpreted as "higher priority".
Originating Volume	This is the volume that is first arriving to this facility (and originating to the region) via this shipment asset. The units are the minimum default freight unit used for this scenario).	It is not necessary to have an originating volume assigned to a scheduled service; however, a scheduled service must have some volume (originating or outbound) assigned to be valid.
Originating Freight Type	This is the originating freight type associated with the originating volume. If multiple freight types arrive on a shipment asset, multiple records need to be defined.	A freight type must be associated with each originating volume. A pull down list of available freight types that has been defined in the "library data" is referenced here.
Originating Next	This is a pull down of the outbound distributions	

Dest Distribution	that are defined in the Outbound Distributions form within the Facility Data..	
Description	This is an optional field where the user can further describe the scheduled service sequence represented within this record.	

Outbound Distributions: This form allows the user to enter how freight units leave a given facility. In many cases, freight units can depart a facility in multiple ways—by truck, by rail, etc. The data entries in this form allow for the user to define the proportion of freight units that leave a facility and what next facility they will be routed to (or exit the region if applicable).

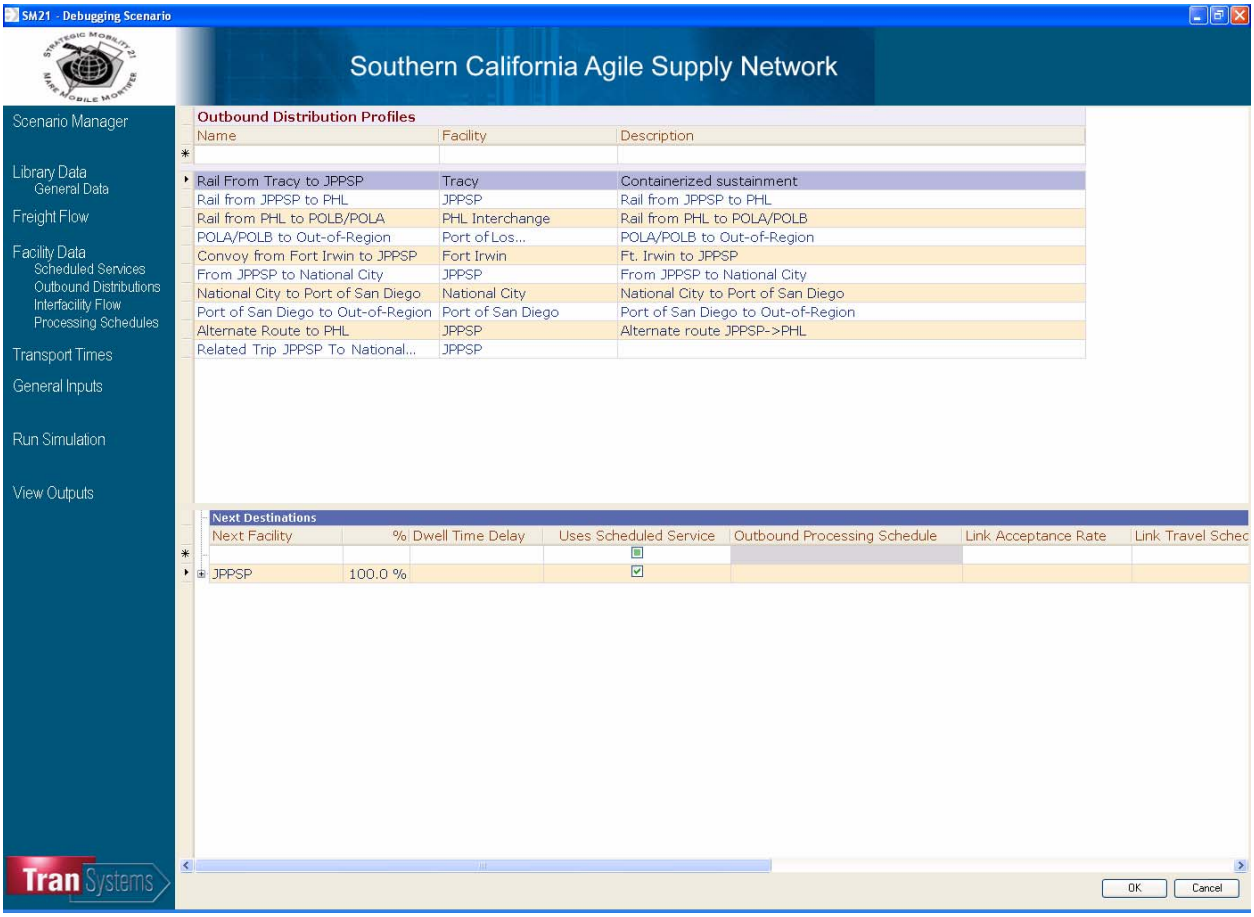

Figure 15: Outbound Distributions (Part A)

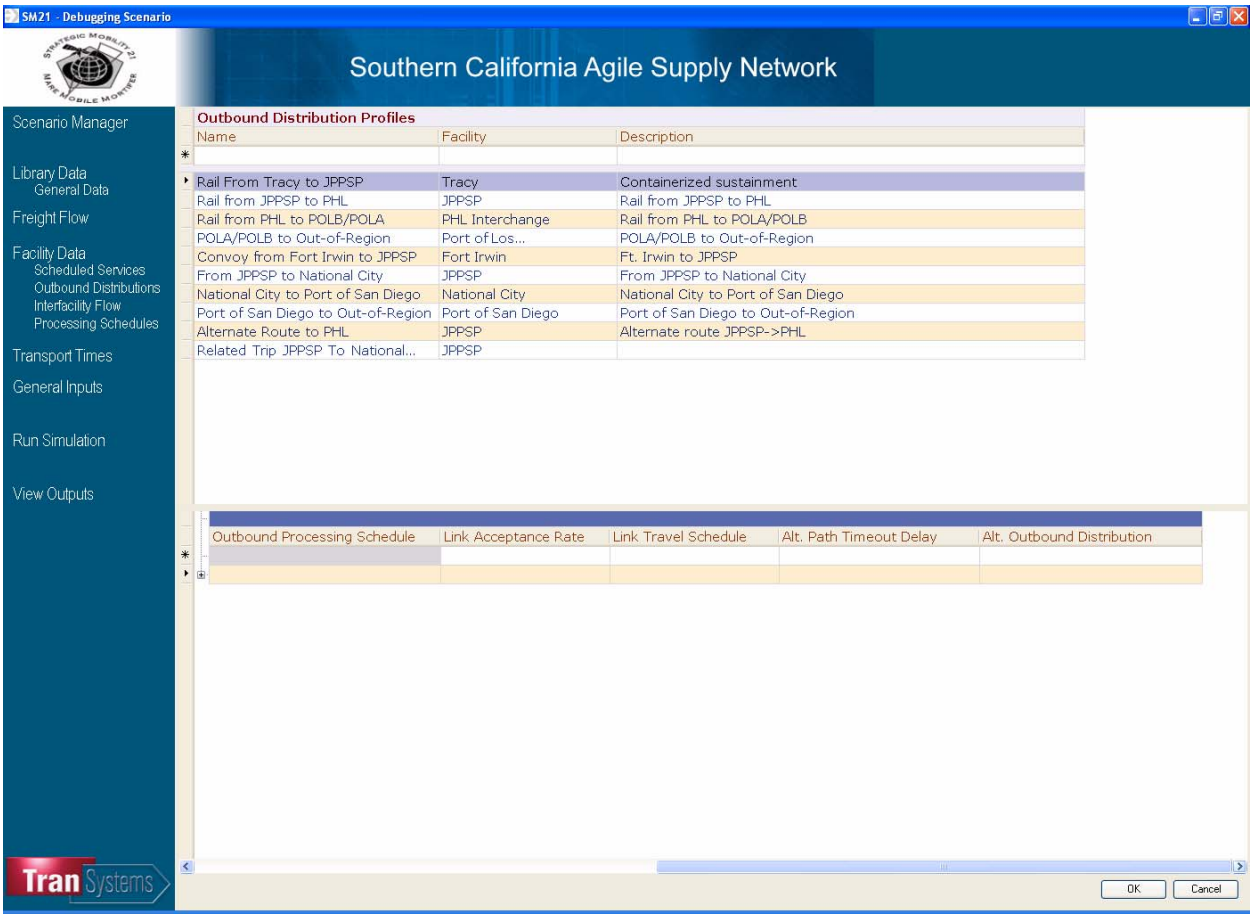

Figure 16: Outbound Distributions (Part B)

This form is organized using a main form-subform type of display. On the Main form, the following is specified:

FIELD	DESCRIPTION	NOTE
***Name**	A user-defined name to describe the outbound distribution profile. This name is displayed within other form entry pull-down lists.	
***Facility**	This is a pull down list of the facilities defined within the "library data" section.	If a facility does not appear in the pull down list, it must be defined in library data within the facilities tab/form.
Description	This is an optional field where the user can further describe the scheduled service sequence represented within this record. This is the starting day that this scheduled service sequence will or can begin.	

For the selected Outbound Distribution Profile on the main form, the user can enter the following data into the related "Next Destinations" subform. Note that there can be numerous records associated with an outbound distribution profile—as many records can be defined as there are next destinations (or ways to get to next destinations) from a facility.

FIELD	DESCRIPTION	NOTE
***Next Facility**	This is a pull down list of the facilities defined within the "library data" section.	If a facility does not appear in the pull down list, it must be defined in library data within the facilities tab/form.
***Percentage (%)**	This is a percentage of freight units that arrive at this facility and have this flow as their next step through the region.	All percentages must add up to 100%
Dwell Time Delay	This is a pull down list of the dwell times defined within the "library data" section. This represents the delay time that this freight unit will experience prior to being "ready" for departure (where it is scheduled service or other).	If a dwell time does not appear in the pull down list, it must be defined in library data within the Dwell Times tab/form. If no dwell time is modeled, this field can be left blank.
***Uses Scheduled Service?**	This is a yes/no toggle to indicate whether these freight units leave the facility by a scheduled service or by an outbound processing rate.	Note that if Scheduled Service is "yes", the form controls will "grey" the Outbound Processing Schedule, Link Acceptance Rate, and Link Travel fields for data entry.
Scheduled Service	This is a pull down list of the scheduled services defined with the Facility Data: Scheduled Services form.	This field only accepts user entry if "Uses Scheduled Service?" is yes.
Outbound Processing Schedule	This is a pull down list of the Processing Schedules defined within the Facility Data: Processing Schedules form. This field provides the daily operating schedule for outbound freight units that do not leave by scheduled service.	
Link Acceptance Rate	If scheduled service is not selected, this is a pull down list from the Library Data: Daily Profiles-Transport Link Daily Profiles definitions. After a freight unit is processed out of the facility This field provides the information as to how rapidly the freight unit can depart the facility based on transportation link acceptance rate by time of day.	.
Link Travel	If scheduled service is not selected, this is the time after link acceptance for the freight unit to travel to the next facility. A pull down list from the Library Data: Daily Profiles-Transport Time profile definitions is provided.	
Alternative Path Timeout Delay	This is a time input (in hours) to specify how long the freight unit will wait (after being ready for departure) to depart on the specified outbound flow. After this time elapses, it the freight unit has been able to depart on its "preferred" method, an alternate outbound distribution can be specified.	It is only necessary to enter a non-zero value if there is an alternate method for this freight unit to depart.
Alternative Outbound Distribution	This is a pull down list of other outbound distribution profiles that have been defined and is used to determine the alternate path for this freight unit.	

Interfacility Flow: Freight units that are being transferred between facilities (as opposed to those that originate through a facility) need to be defined in terms of the inbound processing rate to get into their next facility. Once they get there, they also need to be defined in terms of how they will depart the facility. This form provides the information to define how interfacility flows are managed to and from their next facility.

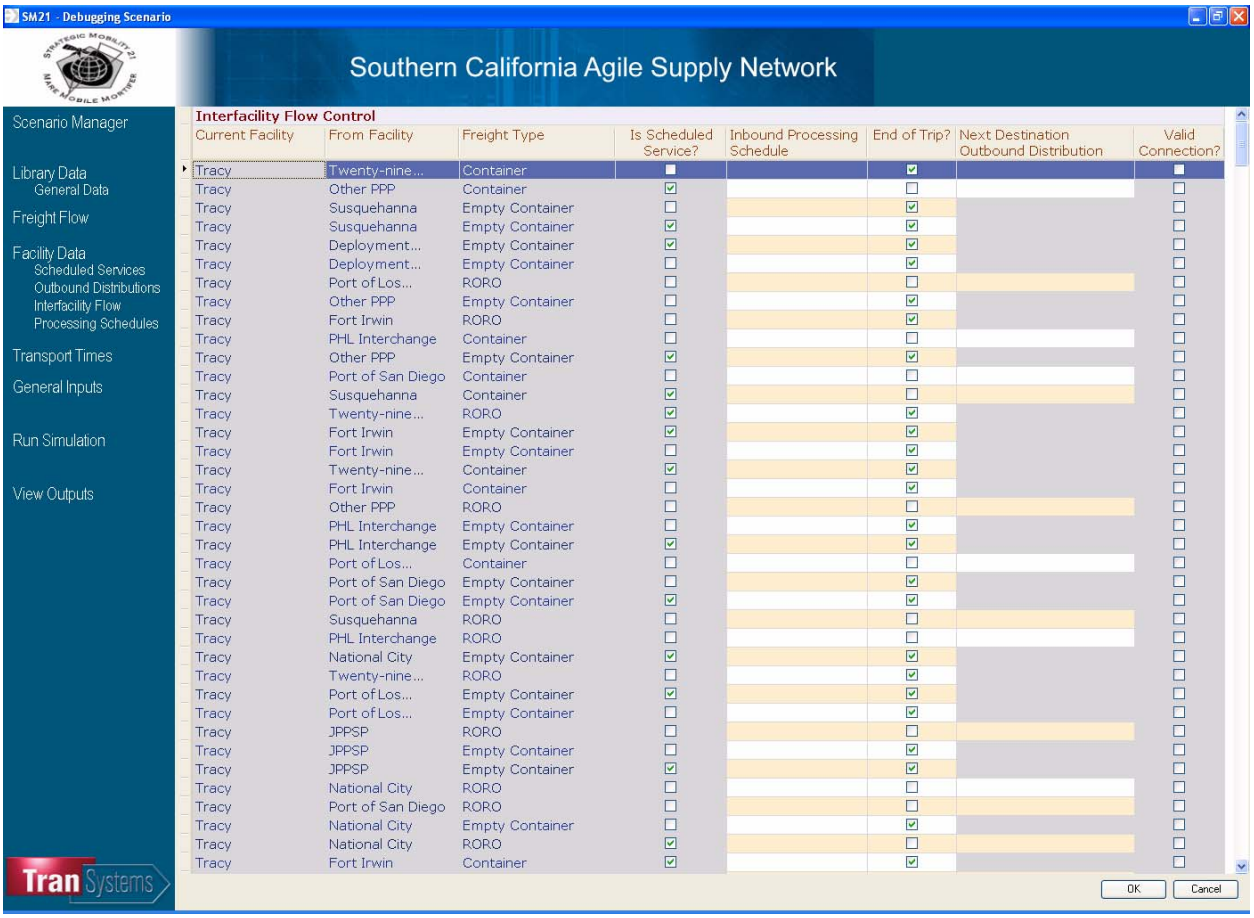

Figure 17: Interfacility Flow Control

FIELD	DESCRIPTION	NOTE
Current Facility	This field is not user editable, it is a record that has been built from the Freight Flow inputs within Visio.	Not editable in this form.
From Facility	This field is not user editable, it is a record that has been built from the Freight Flow inputs within Visio.	Not editable in this form.
Freight Type	This field is not user editable, it is a record that has been built from the Freight Flow inputs within Visio.	Not editable in this form.
Is Scheduled Service?	This field is not user editable. This is to note whether this is a flow that uses a scheduled service.	Not editable in this form.
***Inbound Processing**	This is a field that has a pull down list of the	Note that this rate is only applied to

Schedule	Processing Schedules defined within the Facility Data section. This is used to define the rate at which the freight unit can be processed into the facility once it arrives there.	freight units that arriving to the facility not via a scheduled service.
Is End of Trip?	This field is used to specify if the freight unit is ending its trip once arriving into this facility. If it is, the freight unit will no longer continue flowing through the region and output statistics will be collected (cycle time, etc.)/	The default setting on this toggle is "no".
Next Destination Outbound Distribution	This filed is a pull down list of the outbound distribution profiles that have been defined within the Facility Data: Outbound Distribution form.	This field applies to how interfacility freight units will depart their next facility (regardless of arriving via scheduled service or other).
Valid Connection?	This field is automatically generated (not user editable) if this from-to facility combination has been defined in the Freight Flow tool. Only records that have Is Valid? Will be displayed within this form.	It is not necessary to have data entered for every interfacility flow that is valid.

Processing Schedules: This form allows the user to enter both inbound and outbound processing schedules. These are referenced in other forms within the facility data (as noted in previously described look-up fields) and are used to determine the rate (or business hours in many cases) when freight units can enter the facility once they have arrived there or depart the facility once they have been determined to be "ready" to depart. These processing schedules are not applicable for freight units arriving or departing via scheduled services.

The processing schedules form has separate tabs for inbound and outbound processing schedules. The input format is similar to both. The design of the data structures allow for the concept of reusing schedules—especially as many facilities and days of the week within a facility will have similar or identical operating schedules. These schedules reference definitions provided within the "Library Data-Daily Profiles" forms. The inbound and outbound schedules have very similar input forms, for simplicity the inbound schedule inputs are described in this document.

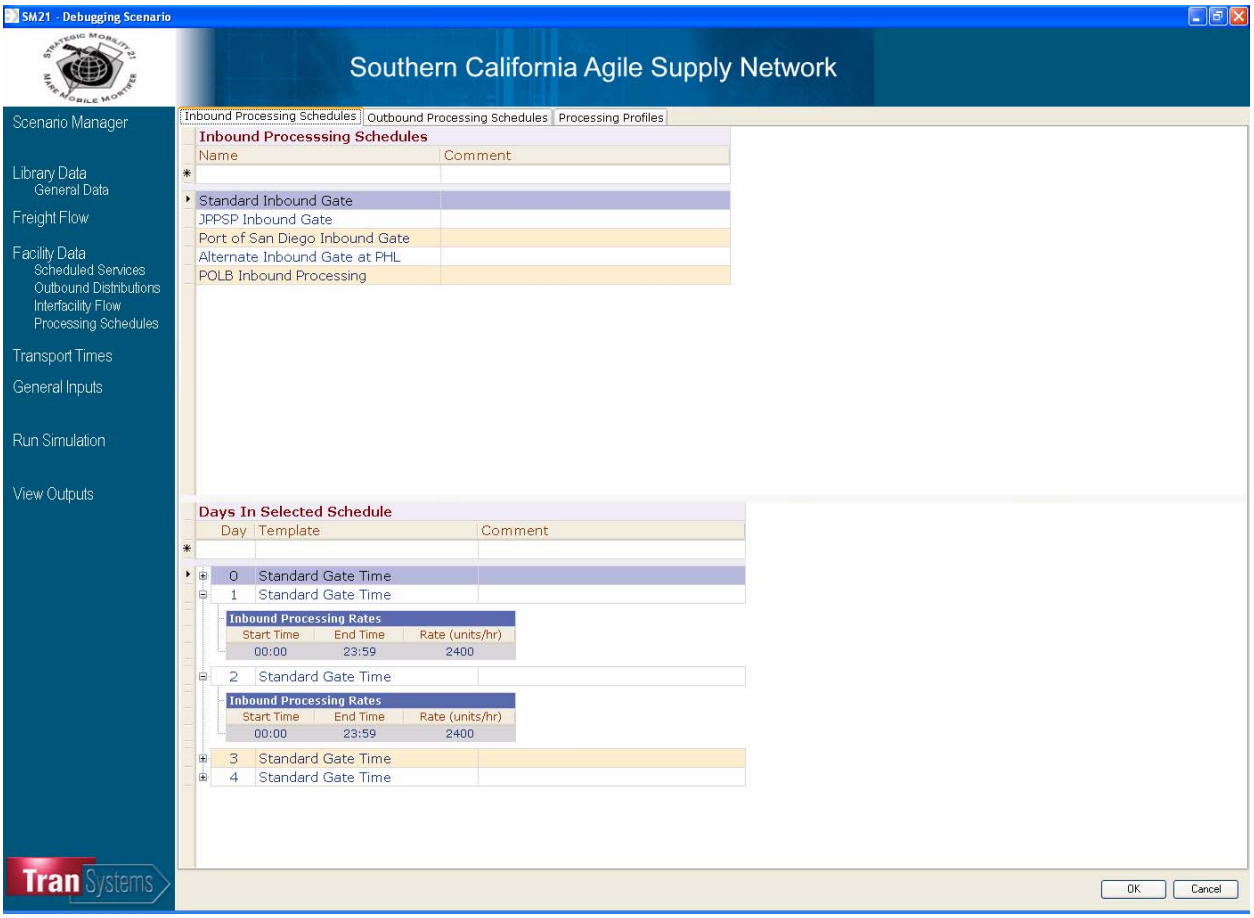

Figure 18: Processing Schedules-Inbound Schedules Form

This form is organized with a main form-sub form format. On the main form the user can define an inbound processing profile name. Associated with each inbound processing schedule can be definitions of the daily profiles within that schedule. The subform " Days in Selected Schedule" allows for repeating or unique daily schedules to be defined. Pull downs are provided to reference the definitions provided in the "Processing Schedules: Processing Profiles" tab/form.

FIELD	DESCRIPTION	NOTE
***Day**	This field is an integer day value from 0 through the end of the scenario run period.	The user must enter a daily profile template for each day within the scenario run period.
***Template**	This field is a expandable form that allows for a set of templates to be defined to represent repeating schedules that may repeat Monday through Friday and be unique on Saturday, Sunday, etc. .	

In the screen capture in Figure 18: Processing Schedules-Inbound Schedules Form there is another subform displayed to show the hourly rate details. This information is read-only and

provided for user reference.

4.1.5 Transport Times

A section of the SCASN database allows for the definition of transportation times in terms of link acceptance rates and travel times to facility destinations. The model allows for transportation link and travel times to vary by day of week and also by time interval within a day to reflect peak congestion delays vs. off-peak, etc. These forms have been design to facilitate reusability of data—especially in situations where many trucks will travel on the same highway corridors, etc. There are four tabs in the Transport Times form: 1) Link Accept Rates, and 2) Travel Times. A similar format is used for both link acceptance rate and travel time data entry, this document describes the link acceptance rate inputs.

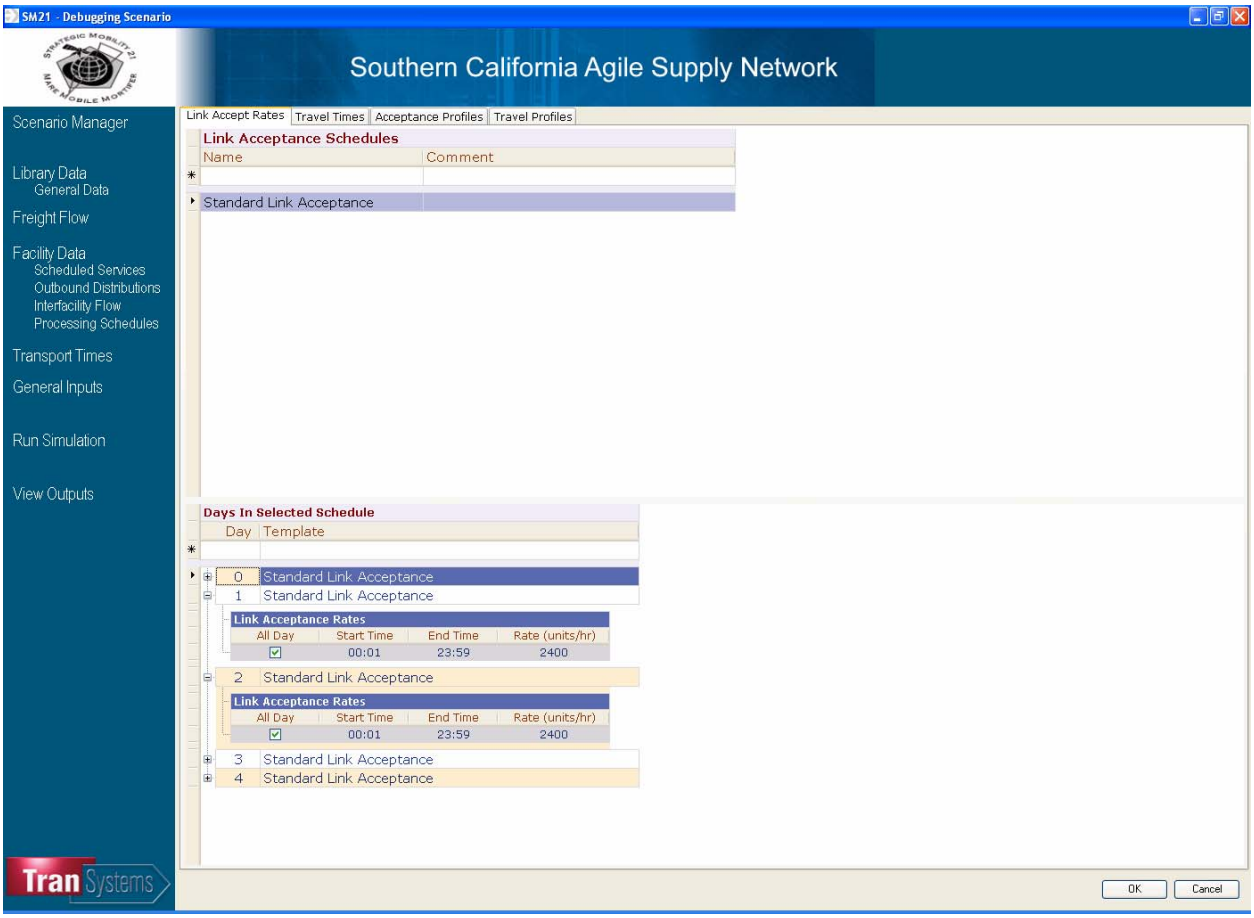

Figure 19: Transport Times-Link Accept Rates

This form is organized with a main form-sub form format. On the main form the user can define a Link Acceptance Schedule name which is used as a reference in other form field pull-downs that use this information. The subform allows for the entry of daily link acceptance rates for each day of the scenario run period.

FIELD	DESCRIPTION	NOTE
***Day**	This field is an integer day value from 0 through the end of the scenario run period.	The user must enter a daily profile template for each day within the

		scenario run period.
***Template**	This field is a pull down of the daily profiles of link acceptance rates defined within the "Transport Times: Acceptance Profiles" form:	

In the screen capture in Figure 19: Transport Times-Link Accept Rates, there is another subform displayed to show the hourly rate details. This information is read-only and provided for user reference.

4.1.6 General Inputs

A simple form is provided to allow the user to specify how long the model is desired to run as well as the desired interval for graphical output. These inputs are shown in Figure 20: General Inputs Form:

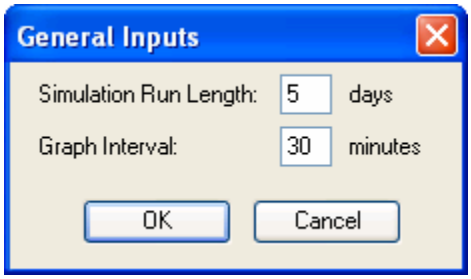

Figure 20: General Inputs Form

4.1.7 Run Simulation

This link automatically launches Arena and the SCASN simulation model. A control form will be displayed to allow the user to select the quantity of replications to run the model to explore impacts of system variability, etc.

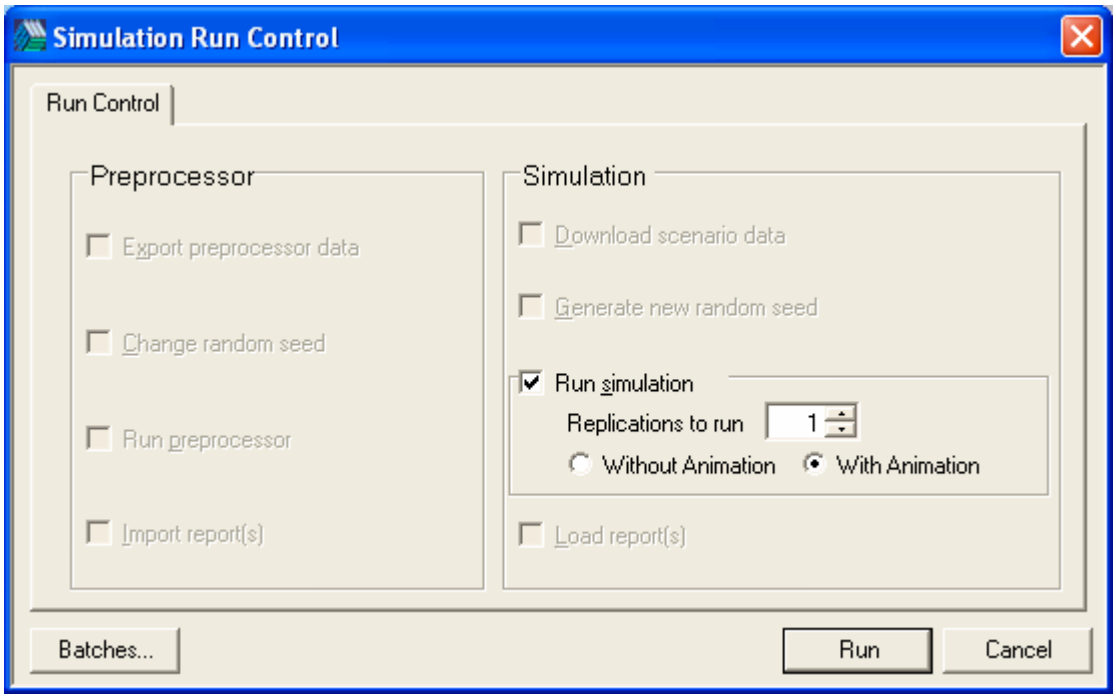

Figure 21: Simulation Run Control Form

4.1.8 View Outputs

This link launches a Microsoft Excel template that loads the model output reports. The simulation model creates output "log" type text files that are automatically imported into Microsoft Excel such that pivot-table, graphs and other output types created. These log files will provide detailed information on each facility, transportation links, and scheduled service performance. The user has the opportunity to do any type of ad-hoc analysis using this information such as:

- How many freight units (by type) accumulate within each facility?
- What is the cycle time of each freight unit through the region?
- What is the cycle time of each freight unit within a facility?
- When a shipment asset departs, what was the load utilization?
- How many freight units accumulate attempting to get onto transportation links?
- How many freight units accumulate attempting to get into a facility?
- What are the vehicle-miles traveled within the region?

When the "View Outputs" link is activated, Microsoft Excel automatically launches and the following screen is shown:

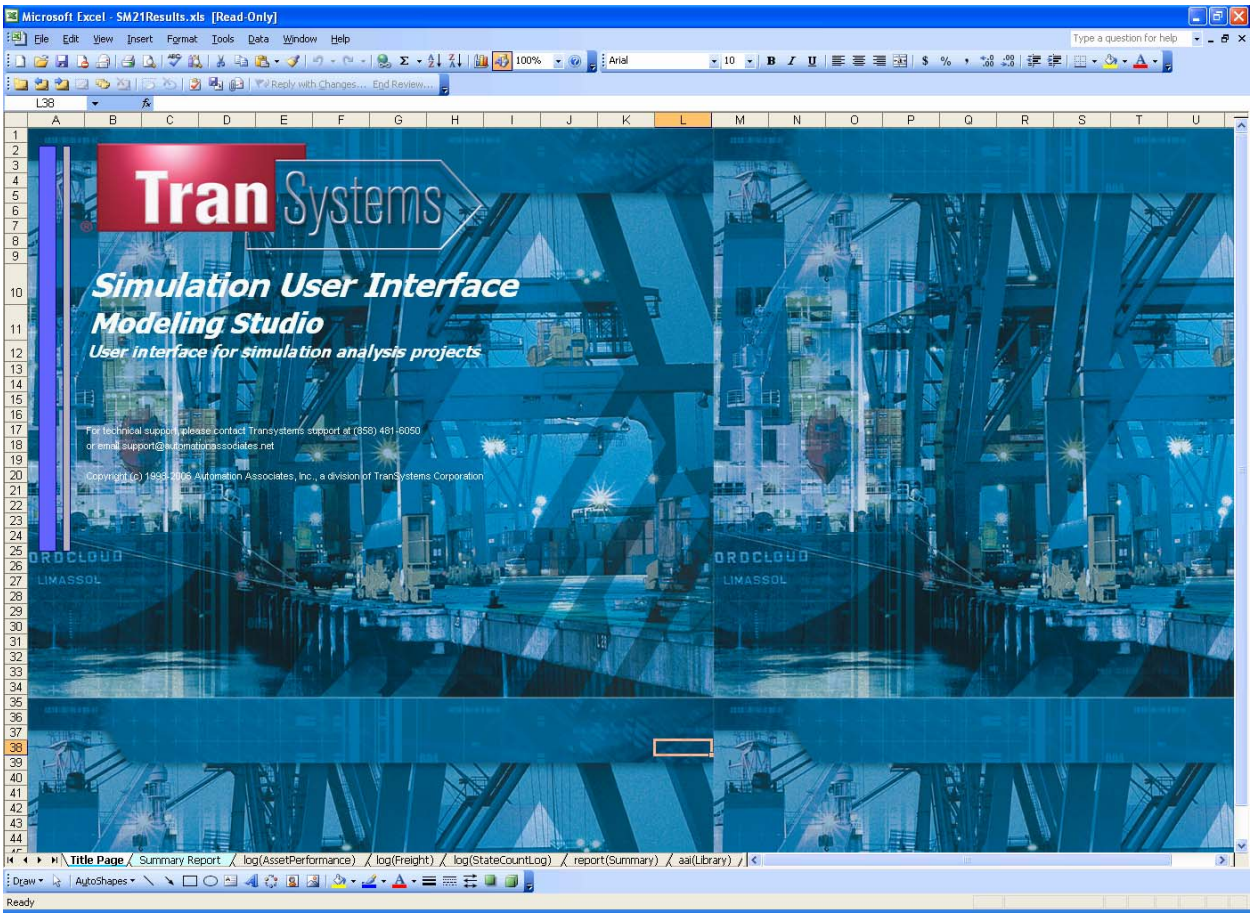

Figure 22: SCASN Output Spreadsheet

Within this spreadsheet the following sheets/tabs are available:

Summary Report: An overall summary or scorecard of regional freight flow performance:

SIMULATION OUTPUTS		
Run Time	120.0	Hours

SUMMARY STATISTICS				
	Min	Avg	Max	
Vehicle Miles Traveled	0	60.909	100	miles/vehicle
Facilities Visited	4	4	4	facilities/unit
Time in System	59.4774	91.857	119	hours/unit

FREIGHT UNIT FLOW		
Introduced	3,862	units
Exited via Scheduled Service	8,116	units

Exited via Outbound Processing	4,136	units
Transported	10,874	units
Reached Destination	2,200	units

Log(Asset Performance):: This time-ordered log shows the performance of each scheduled service in terms of the following fields:

Asset	Scheduled Service Event	Start time	End Time	Desired outbound	Actual Outbound (	Desired Originating C	Acutal Originating Containers
null	Originating at Tracy	0	0	0	0	1066	1066
null	Rail from Tracy to JPPSP	1	1	267	267	0	0
null	Rail from JPPSP to PHL #1	5	5	150	150	0	0
null	Rail from JPPSP to PHL #2	7	7	100	100	0	0
null	Rail from PHL to POLA/POLB #1	20	20	240	240	0	0
POLB Ship #1	POLA/POLB to Out-of-Region #1	29	47	240	240	0	0
null	Originating at Fort Irwin	0	288	0	0	6711	2796
null	JPPSP To National City #1	19	19	83	83	0	0
null	JPPSP To National City #2	20	20	84	84	0	0
null	JPPSP To National City #3	20	20	84	84	0	0
null	JPPSP To National City #4	21	21	84	84	0	0
null	Rail from JPPSP to PHL #3	29	29	75	75	0	0
null	Rail from JPPSP to PHL #4	31	31	115	115	0	0
null	Rail from JPPSP to PHL #5	53	53	160	160	0	0
null	Rail from JPPSP to PHL #6	55	55	80	80	0	0
null	Rail from JPPSP to PHL #7	77	77	100	100	0	0
null	Rail from JPPSP to PHL #8	79	79	100	100	0	0
null	Rail from JPPSP to PHL #9	101	101	125	125	0	0
null	Rail from JPPSP to PHL #10	103	103	105	61	0	0
null	Rail from PHL to POLA/POLB #2	44	44	200	200	0	0
null	Rail from PHL to POLA/POLB #3	68	68	180	180	0	0
null	Rail from PHL to POLA/POLB #4	92	92	260	260	0	0
null	Rail from PHL to POLA/POLB #5	116	116	220	186	0	0
POLB Ship #1	POLA/POLB to Out-of-Region #2	53	71	220	200	0	0
POLB Ship #2	POLA/POLB to Out-of-Region #3	78	95	260	180	0	0
POLB Ship #2	POLA/POLB to Out-of-Region #4	102	119	240	240	0	0

This output report is useful to understand how many freight units were successfully transported via each scheduled service. For example, the vessels at POLB supporting the military deployment have a schedule in terms of when they arrive and depart the region. This output can be useful to determine if the timing of the freight unit arrivals to the port arrive in time for successful loading and departure from the region.

Asset	Scheduled Service Event	Start time	End Time	Desired outbound	Actual Outbound (	Desired Originating C	Acutal Ori
POLB Ship #1	POLA/POLB to Out-of-Region #2	53	71	220	200	0	0

For example, if the POLB Ship#1 is filtered in this spreadsheet it can bee seen that 220 outbound containers were targeted for this vessel but only 200 were successfully loaded in time for departure. The model assumes that vessels cannot be held back—this implies that a less aggressive schedule is required or there are more rapid schedules needed to get freight through the region to meet vessel departure times.

Log(Freight): This is the most detailed log and is a time-ordered list of every event that each freight unit requires during its flow through the region. Each freight unit and each event is logged to this file. A unique ID is recorded for each freight unit, this is shown in the "Entity ID" field. Detailed messages are provided to indicate the event that corresponds with that freight unit. Also, the facility and other information is available for data filtering, etc. A partial list of events that are logged for each freight unit are listed as follows:

- Accepted into transportation network

- Accessing transportation network
- Begin inbound scheduled service
- Begin outbound scheduled service
- Completed inbound scheduled service
- Completed facility dwell time
- Completed outbound processing
- Completed outbound scheduled service
- Completed transporting
- Entered inbound facility
- Exiting via Outbound Processing
- Exiting via Scheduled Service
- Freight unit entered inbound processing
- Freight unit entered outbound processing
- Freight unit loaded onto outbound scheduled service
- Picked up freight unit
- Reached destination
- Reached required volume capacity
- Scheduled Service entered inbound processing
- Unloading inbound freight unit
- Waiting for freight units to arrive

Time	Entity ID	Category	Message	a_CurrentFacility	a_PreviousFacili	a_ScheduleIndex	a_ScheduledServic	a_Outbou	a_FrieghtU
0	10	Inbound scheduled service	Begin inbound scheduled service	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container
0	10	Inbound scheduled service	Unloading inbound freight unit	Tracy	null	0	Originating at Tracy	1	Container

Log(StateCountLog): This is a log that is generated at the specified reporting time interval (an in put using the General Inputs form). This log shows the quantity of freight units (each type) within each state at each facility. The states that are recorded per facility are:

- OriginatingScheduleService: Originating to facility via Scheduled Service
- Facility Dwell: Count of freight units within facility undergoing internal processes.
- OutboundScheduleService: Count of freight units waiting for departure via Outbound Schedule Service.
- Transportation Acceptance: Count of freight units waiting to be transported out of the facility via a transportation link.
- Transportation Delay: Count of freight units undergoing a transportation delay from this facility enroute to their next destination.
- Inbound Processing: Count of freight units waiting to complete inbound processing.
- Outbound Processing: Count of freight units waiting to complete outbound processing

Time	Facility	FrieghtUnit	OriginatingScheduleService	FacilityDwell	OutboundScheduleService	TransportationAccepta	TransportationDelay
0	Tracy	Container	0	0	0	0	0
0	Tracy	RORO	0	0	0	0	0
0	Tracy	Empty Container	0	0	0	0	0
0	Susquehanna	Container	0	0	0	0	0
0	Susquehanna	RORO	0	0	0	0	0
0	Susquehanna	Empty Container	0	0	0	0	0
0	Other PPP	Container	0	0	0	0	0
0	Other PPP	RORO	0	0	0	0	0
0	Other PPP	Empty Container	0	0	0	0	0
0	JPPSP	Container	0	0	0	0	0
0	JPPSP	RORO	0	0	0	0	0
0	JPPSP	Empty Container	0	0	0	0	0
0	National City	Container	0	0	0	0	0
0	National City	RORO	0	0	0	0	0
0	National City	Empty Container	0	0	0	0	0
0	Port of San Diegc	Container	0	0	0	0	0
0	Port of San Diegc	RORO	0	0	0	0	0
0	Port of San Diegc	Empty Container	0	0	0	0	0
0	PHL Interchange	Container	0	0	0	0	0
0	PHL Interchange	RORO	0	0	0	0	0
0	PHL Interchange	Empty Container	0	0	0	0	0
0	Port of Los Angel	Container	0	0	0	0	0
0	Port of Los Angel	RORO	0	0	0	0	0
0	Port of Los Angel	Empty Container	0	0	0	0	0
0	Deployment Dest	Container	0	0	0	0	0
0	Deployment Dest	RORO	0	0	0	0	0
0	Deployment Dest	Empty Container	0	0	0	0	0
0	Fort Irwin	Container	0	0	0	0	0
0	Fort Irwin	RORO	0	0	0	0	0
0	Fort Irwin	Empty Container	0	0	0	0	0
0	Twenty-nine Paln	Container	0	0	0	0	0
0	Twenty-nine Paln	RORO	0	0	0	0	0
0	Twenty-nine Paln	Empty Container	0	0	0	0	0
0.5	Tracy	Container	0	0	1066	0	0
0.5	Tracy	RORO	0	0	0	0	0
0.5	Tracy	Empty Container	0	0	0	0	0
0.5	Susquehanna	Container	0	0	0	0	0
0.5	Susquehanna	RORO	0	0	0	0	0
0.5	Susquehanna	Empty Container	0	0	0	0	0
0.5	Other PPP	Container	0	0	0	0	0
0.5	Other PPP	RORO	0	0	0	0	0

5 SCASN MODEL LOGIC

To provide the user with an orientation as to how the SCASN Arena-based simulation model was constructed, the following logic flowchart is provided:

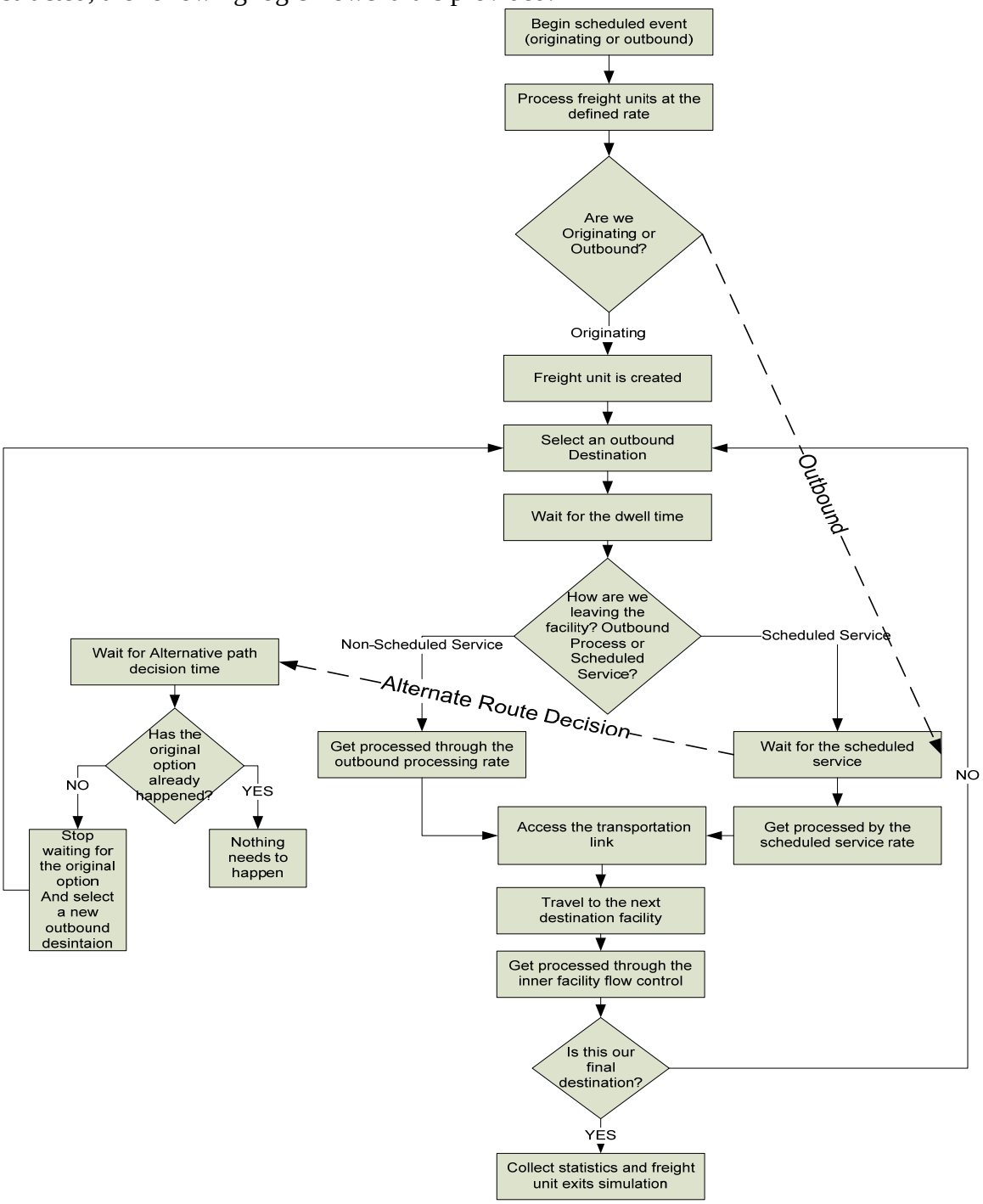

Figure 23: SCASN Simulation Model Logic Flowchart

The model logic is executed by individual entities that represent individual freight units. Because of this level of detail it is possible to look at freight unit cycle time through the system (region) and attain statistics on each state (or event) that a freight unit requires to move through the system.
The model structure is fundamentally organized with "queues" and "delays". Queues are places within the model where the freight unit waits for an unknown (unspecified) amount of time; delays are places within the model where the freight units wait for specified amount of time (based on model inputs). Queues provide useful information to diagnose congestion such as time waiting and quantity of freight units accumulated within a facility, etc. Delays are used to transfer entities between processing steps such as traveling on a link between facilities or amount of time a freight unit must remain in a facility to be processed, etc.

All of the queues in the model provide information as to how much time units are waiting within the system: 1) Wait for outbound departure, 2) Wait for transport to the next facility, and 3) Wait for entry to next facility. These queues can provide statistical output such as the time in queue as well as the volume that may accumulate in each queue. This information will provide the basis for the network performance measures as outlined previously. The following timelines provide further illustration as to the timing relationships in the model:

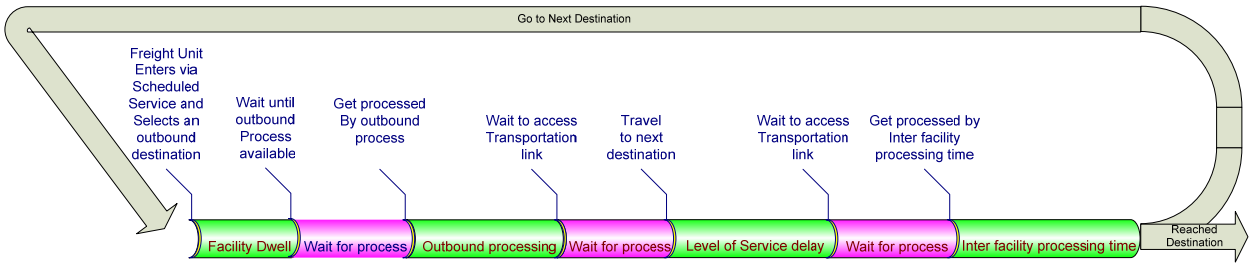

Figure 24: Freight Units and Model Queue Times

In addition to the time that freight units spend in queues, there are sources of variability (associated with "delays") that will add time to freight units. Variability can be associated with the following elements:

1. Facility Dwell: minimum, mode, maximum time in facility
2. Transportation Link Acceptance Rate: This rate can vary by the time of day that the freight unit departs a facility and attempts to access a transportation link.
3. Transportation Link Movement Time: The time that freight units take to travel to their next facility once they have been accepted on a transportation link and can vary by time of day.